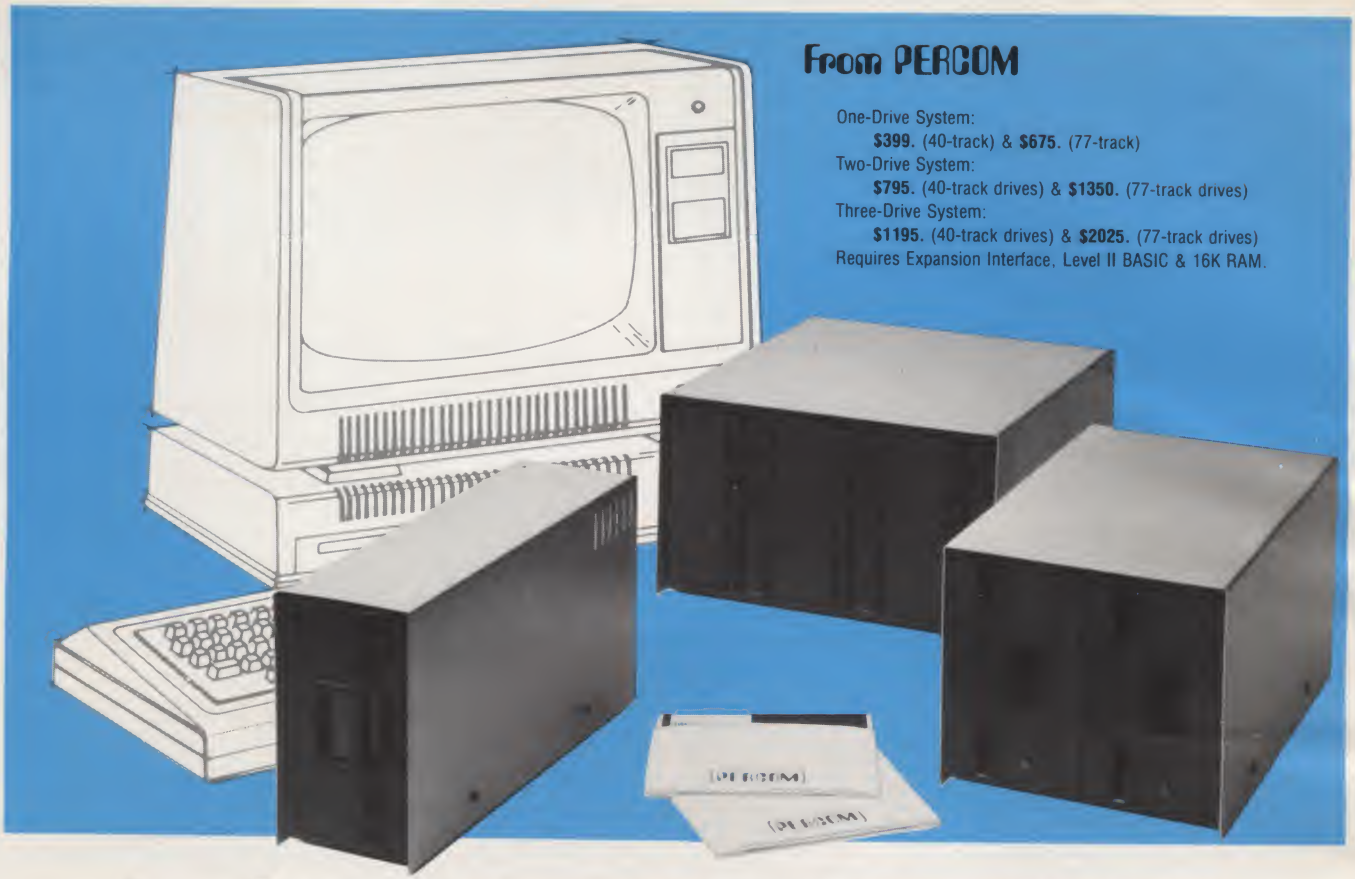
August 1979
$2.50

kilobaud

MICROCOMPUTING™

for business . . . education . . . FUN!



Low Cost Add-On Storage for Your TRS-80*. In the Size You Want.

When you're ready for add-on disk storage, we're ready for you. Ready with six mini-disk storage systems — 102K bytes to 591K bytes of additional *on-line* storage for your TRS-80*.

- **Choose either 40-track TFD-100™ drives or 77-track TFD-200™ drives.**
- **One-, two- and three-drive systems immediately available.**
- **Systems include Percom PATCH PAK #1™, on disk, at no extra charge. PATCH PAK #1™ de-glitches and upgrades TRSDOS* for 40- and 77-track operation.**
- **TFD-100™ drives accommodate "flippy disks." Store 205K bytes per mini-disk.**
- **Low prices. A single-drive TFD-100™ costs just $399. Price includes PATCH PAK #1™ disk.**
- **Enclosures are finished in system-compatible "Tandy-silver" enamel.**

Whether you need a single, 40-track TFD-100™ add-on or a three-drive add-on with 77-track TFD-200™s, you get more data storage for less money from Percom.

Our TFD-100™ drive, for example, lets you store 102.4K bytes of data on one side of a disk — compared to 80K bytes on a TRS-80* mini-disk drive — and 102.4K bytes on the other side, too. Something you can't do with a TRS-80* drive. That's almost 205K bytes per mini-disk.

And the TFD-200™ drives provide 197K bytes of on-line storage per drive — 197K, 394K and 591K bytes for one-, two and three-drive systems.

PATCH PAK #1™, our upgrade program for your TRSDOS*, not only extends TRSDOS* to accommodate 40- and 77-track drives, it enhances TRSDOS* in other ways as well. PATCH PAK #1™ is supplied with each drive system at no additional charge.

The reason you get more for less from Percom is simple. Peripherals are not a sideline at Percom. Selling disk systems and other peripherals is our main business — the reason you get more engineering, more reliability and more back up support for less money.

In the Product Development Queue . . . a *printer interface* for using your TRS-80* with any serial printer, and . . . the *Electric Crayon*™ to map your computer memory onto your color TV screen — for games, animated shows, business displays, graphs, etc. Coming PDQ!

™ TFD-100, TFD-200, PATCH PAK and Electric Crayon are trademarks of PERCOM DATA COMPANY.
*TRS-80 and TRSDOS are trademarks of Tandy Corporation and Radio Shack which have no relationship to PERCOM DATA COMPANY.

PERCOM

P7

PERCOM DATA COMPANY, INC.
DEPT. K • 211 N. KIRBY • GARLAND, TX. 75042

To order add-on mini-disk storage for your TRS-80*, or request additional literature, call Percom's toll-free number: 1-800-527-1592. For detailed Technical information call (214) 272-3421.

Orders may be paid by check or money order, or charged to Visa or Master Charge credit accounts. Texas residents must add 5% sales tax.

Percom *'peripherals for personal computing'*

SuperBrain™

The Honor Graduate

There's been a lot of talk lately about intelligent terminals with small systems capability. And, it's always the same. The systems which make the grade in performance usually flunk the test in price. At least that was the case until the SuperBrain graduated with the highest PPR (Price/Performance Ratio) in the history of the industry.

For less than $3,000*, SuperBrain users get exceptional performance for just a fraction of what they'd expect to pay. Standard features include: two dual-density mini-floppies with 320K bytes of disk storage, 64K of RAM to handle even the most sophisticated programs, a CP/M Disk Operating System with a high-powered text editor, assembler and debugger. And, with SuperBrain's S-100 bus adapter, you can even add a 10 megabyte disk!

More than an intelligent terminal, the SuperBrain outperforms many other systems costing three to five times as much. Endowed with a hefty amount of available software (BASIC, FORTRAN, COBOL), the SuperBrain is ready to take on your toughest assignment. You name it! General Ledger, Accounts Receivable, Payroll, Inventory or Word Processing . . . the SuperBrain handles all of them with ease.

Your operators will praise the SuperBrain's good looks. A full ASCII keyboard with a numeric keypad and function keys. A non-glare, dynamically focused, twelve inch screen. All in an attractive desktop unit weighing less than a standard office typewriter. Sophisticated users will acclaim SuperBrain's twin Z-80 processors which transfer data to the screen at 38 kilobaud! Interfacing a printer or modem is no problem using SuperBrain's RS-232C communications port. But best of all, you won't need a PhD in computer repair to maintain the SuperBrain. Its single board design makes servicing a snap!

So don't be fooled by all the freshman students in the small systems business. Insist on this year's honor graduate . . . the SuperBrain.

*Quantity one. Dealer inquiries invited.

INTERTEC DATA SYSTEMS®

2300 Broad River Road, Columbia, SC 29210
(803) 798-9100 TWX: 810-666-2115

PUBLISHER'S REMARKS

Wayne Green

MSI Meeting at Vail

These photos were taken at the Vail CO meeting of Midwest Scientific Instruments, and around Vail.

Europe

The recent Paris Microcomputer Expo furnished clear proof that microcomputing is very much alive in Europe. The exhibit area was absolutely packed for the three days of the show.

In addition to European firms, including an exciting new outfit from Sweden, several American manufacturers came over for the show. North Star was showing off their new disk system and getting a lot of attention. Despite a great deal of industry contention that no one would be able to produce a really successful dual-side, dual-density disk system, North Star had one on display . . . running.

Bill Gates was there too, taking orders for Microsoft. His booth was busy just about every minute of the show.

A surprise showing was from Wave Mate, now being primarily distributed in Europe. Their new system has been remarkably developed and looks very good.

These European shows are strengthening. Most of the attendance is from business buyers rather than hobbyists, so exhibiting can be very exciting. The next show of significance appears to be an Electro-Hobby show in Stuttgart, October 3-7th this year. *Microcomputing* is cooperating with this show and will definitely exhibit. *Kilobaud* did run a microcomputer show in Munich last November, and it pulled in close to 10,000 attendance. We'll be running another show next year, probably in Munich.

Traveling in Europe is expensive these days, as I found in my recent visit. The main purpose of the trip was to lay the groundwork for distribution of Instant Software in Europe, plus boost the circulation of *Microcomputing*. The trip this year was quite a different matter from the one I made 20 years ago when I first started visiting Europe.

Old-timers may remember a

Curt Childress, the president of MSI, ready for some skiing after the busines meetings.

The participants in the MSI meeting. First row, l-r: Bud Pass, John Billings, Jeff Harrow, Dana Peterson, Alfonso Langoria; second row, l-r: Glenn Krebs, Dave Crocker, Art Childress, Jaap Van Duffelen, Hal Hoffman, Dennis Seager (standing); third row, l-r: Richard Hinton, George Parsons, Irwin Pollard, James Bird, Mark Asplund, Wally Solotow; back (jagged) row, l-r: Lew Gordon, Mike Arnold, Chuck Martin, Denny Kessler.

Reader Responsibility

One of your responsibilites, as a reader of *Kilobaud MICROCOMPUTING*, is to aid and abet the increasing of circulation and advertising, both of which will bring you the same benefit: a larger and even better magazine. You can help by encouraging your friends to subscribe to *Kilobaud MICROCOMPUTING*. Remember: Subscriptions are guaranteed—money back if not delighted, so no one can lose. You can also help by tearing out one of the cards just inside the back cover and circling replies you'd like to see: catalogs, spec sheets, etc. Advertisers put a lot of trust in reader requests for information. To make it more worth your while to send in the card, a drawing will be held each month and the winner will get a lifetime subscription to *Kilobaud MICROCOMPUTING*!

The latest winner of a lifetime subscription to *Microcomputing* is Gerard R. Langlais of Yonkers NY.

Details of new accounting package are explained to MSI dealers, showing menu on projection screen at right and sample printout on projector at center.

Vail is a small, largely condominium community, where skiing is the reason for being there in the winter. It is a lovely, small town with lots of shops and restaurants. Didn't see Ford there.

book by Frommer, *Europe on $5 A Day*. I had no problem 20 years ago in traveling around Europe for that amount of money. A room in a small hotel with breakfast was around $2, a nice dinner was about the same price and a lunch for under a dollar was commonplace. At that time the salaries in the U.S. were around twice those of most Europeans for the same type of work.

Today it is a different matter. European salaries are 50 percent or more above similar salaries here, and there are few bargains available in anything. You will find it difficult to have much of a dinner for under $10. Unless you plan to spend around $100 per day you are going to be watching your money at every turn. Now I find that Europeans are coming to the U.S. for inexpensive vacations!

What happened? What went wrong? How did we get from making two or more times as

(continued on page 24)

OUTPUT FROM ISI

Sherry Smythe

Conquering Europe

With microcomputers just making inroads in Europe, there is as much need for programs for that market as there is in the U.S. For readers with native language background in other languages, this offers an opportunity.

Many of the programs being sold or readied for sale in the U.S. can also be sold in other countries if the programs and the instructions are translated. Staffers at Instant Software are already converting the most promising programs into German and Italian (with most of this work being done by our Knud Keller, a native of Stuttgart, and Piergiorgio Saluti, recently arrived from Italy).

Associate editors interested in working on this project should drop me a line. We need French, Danish, Swedish, Norwegian, Finnish, Spanish and Dutch translations. German, Italian, Portugese and British are covered by our in-house staff.

Program translations are simple, requiring changes in the print statements. The operating instructions are a bit more complicated, but not much. The work pays the usual peon wages of $3 per hour, but you can do it at home, when you please and at your own convenience—and it is fun.

European Business

Obviously, there are differences between some of the business programs needed for use in Europe and those for the U.S. For example, our payroll programs don't work in Europe. European readers of *Microcomputing* should think seriously about tackling simpler programs oriented toward European business (e.g., value added taxes) and submit such programs for publication to the international program publishers. The original language is not terribly important.

In writing programs for Europe, please remember that the best-selling systems there are the PET and TRS-80, which are about neck and neck, with the Apple II (known over there as the ITT-2020) coming on strong. Europe is not as game oriented as the U.S., so business-oriented programs are more urgently required.

American Business

Business-oriented programs have been lagging behind. This is understandable since most of the more useful business programs have had to wait for the hardware to be developed and debugged . . . then the program language . . . and on top of that a good operating system, all before serious business software could be developed.

While most game programs take a few days or weeks to perfect, business software often takes months to prepare. In that context you can understand why good business-application soft-

About the Cover

This month's cover shows the 80-column Trendcom 200 and the 40-column Trendcom 100 from Trendcom of Sunnyvale CA. These new printers use thermal printing to provide hard-copy output up to 40 cps. For details on the Trendcom 100, see p. 20.

kilobaud T.M. MICROCOMPUTING

Publisher/Editor
Wayne Green
Executive Vice President
Sherry Smythe
Assistant Publisher/Editor
Jeffrey D. DeTray
Managing Editor
John Barry
Editorial Assistants
Dennis Brisson
Susan Gross
Administrative Assistant
Dotty Gibson
Production Department
Manager:
Lynn Panciera-Fraser
Staff:
Judith Dalby
Robert Drew
James H. Gray II
Bruce Hedin
Carl Jackson
Dion Owens
Noel R. Self
Robin M. Sloan
John W. White
Typesetting
Barbara J. Latti
Sara Bedell
Mary Kinzel
Holly Walsh
Photography
Bill Heydolph
Tedd Cluff
Projects Editor
Jim Perry
Associate Editors
Phil Feldman
Steve Fuller
Rod Hallen
Len Lindsay
Tom Rugg
Peter Stark
Sherm Wantz
Ken Widelitz
Bookkeeper
Knud E. M. Keller
Marketing/Circulation Mgr.
Robert LaPointe
Bulk Sales Mgr.
Judy Waterman
Asst. Circulation Mgr.
Mary Beth Stanek
Circulation
Pauline Johnstone
Computer Programming
Richard Dykema
Instant Software Micro Lab
William F. Gollan
Scott Spangenberg
Cida Teixeira
Palmer T. Wolf
Stan Wszola
European Marketing Dir.
Reinhard Nedela
Australian Distributor
Katherine Thirkell
Advertising
Aline Coutu, Mgr.
Bill York
Marcia Stone
Bill Hogan
Nancy Ciampa
Gaye Halbig
Lori Mugford
Rita Rivard

MICRO INFO

This symbol next to a title in the table of contents indicates that the article is a business-application article.

Manuscripts

Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a self-addressed, stamped envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *Microcomputing* editorial offices. "How to Write for Microcomputing" guidelines are available upon request.

Editorial Offices:

Pine Street
Peterborough NH 03458
Phone: 603-924-3873, 924-3874

Advertising Offices:

Elm Street
Peterborough NH 03458
Phone: 603-924-7138, 924-7139

Circulation Offices:

Phone: 603-924-7296

To subscribe, renew or change an address:

Write to *Microcomputing*, Subscription Department, PO Box 997, Farmingdale NY 11737. For renewals and changes of address, include the address label from your most recent issue of *Microcomputing*. For gift subscriptions, include your name and address as well as those of gift recipients. Postmaster: Send change of address information to *Microcomputing*, PO Box 997, Farmingdale NY 11737.

Subscription problem or question:

Write to *Microcomputing*, Subscription Department, PO Box 997, Farmingdale NY 11737. Please include an address label.

Kilobaud *Microcomputing* (USPS 346-690) is published monthly by 1001001, Inc., Pine St., Peterborough NH 03458. Subscription rates in U.S. and Canada are $18 for one year and $45 for three years. In Europe: *Microcomputing* erscheint monatlich bei Fachzeitschriftenvertrieb Monika Nedela, 7778 Markdorf, Markstr. 3. Australia: For subscriptions write—Katherine Thirkell, Sontron Instruments, 17 Arawatta St., Carnegie, Vic. 3163 Australia. Please write for other foreign rates. Second-class postage paid at Peterborough NH 03458 and at additional mailing offices. Phone: 603-924-3873.

ware is just now beginning to show up. I don't think any reliable software publisher can check out and publish a complex program any faster than our experience with Instant Software has proven: about six months from submission to appearance in the stores.

Game programs are selling well, but most of them have to sell at the lowest prices, so this limits programmer royalties. Business programs are being priced according to the value to the user, so much higher royalties are involved.

It is odd, but even at this relatively late date, I often find people who have put a lot of work into a business program, either for their own use or for a customer, and who have never realized that this same program might be of interest to a thousand—or even ten thousand—other firms. Repeatedly at computer shows I'll see people staring at the array of Instant Software packages with a kind of dazed look. When I start talking with them I find that they have written a program for, say, handling an egg farm. They aren't sure what anyone could do with anything that specialized.

I then ask them how many egg farms they think there might be around the country. As they mull this over they become excited. There are tens of thousands of commercial egg farms, and every one of them is a good prospect for a microcomputer with an egg-farm program.

Which Systems?

The early results of a *Microcomputing* reader survey show that the TRS-80 Level II is clearly number one in ownership, coming in over four times as high as the second place system: the Apple. Not far behind the Apple is the SWTP system. Unfortunately, we are still unable to support this system with programs due to a lack of lab equipment, something we hope will be corrected soon. We do have a large backlog of 6800 programs, but no way to check them out and apply quality control to the finished product. This takes more than one system, obviously.

Number four in the poll is the PET, and we have plenty of equipment support for this system. The Imsai came in fifth and the Heath H8 system sixth. Both are OK in our lab but need more support. We have H8 programs nearly processed and should publish about two dozen in the next couple of months. We need more.

PET-POURRI

Len Lindsay

Lots of Excitement

PET users have many exciting things waiting for them. Some of this excitement they could do without, however. Commodore created quite a stir when they brought out the new PETs. Soon to be called CBMs, these new PETs have new ROMs that are *not* compatible with the old ones. Although they do correct most of the bugs in PET BASIC (i.e., arrays are no longer limited to 255 elements), they also introduce their own problems. In addition to the serious problem of incompatibility from old to new, the new PETs function differently in lowercase mode.

Unshifted characters are lowercase as on a typewriter. You shift for uppercase. That's great, if they'd do it right. Now if you use lowercase, your program is limited to only one of the two PET versions. Beautiful lowercase instructions on the old PET look horrible on the new PET. Everything is uppercase except the letters that are supposed to be uppercase. Those are shown as lowercase. To retain compatibility, you must use all uppercase in the graphics mode. This is a major step backwards.

To top it off, Commodore didn't even do the change right anyway. Print something in lowercase on the new PET. Fine! Now have it printed on your printer via the IEEE port. What? All the lowercase letters are printed as uppercase, and the uppercase are printed as lowercase. Why on earth would Commodore do that. The new PET isn't even compatible with itself. A cunning reader will probably come up with the following reason.

A normal printer will not print upper/lowercase correctly. Therefore, you're forced to buy Commodore's printer, which corrects for this. That would be a good reason, if it were true. But Commodore's printer doesn't correct for this. And they have the nerve to include program listings for their dual-disk system printed on their printer with upper/lowercases reversed. Worse yet, they don't print the lower as lowercase, rather it is printed as graphic symbols (i.e., graphics mode). This is in their manual, no less. It sure looks funny. For example, "Should a failure . . . " is listed as: "♥HOULD A FAILURE . . . " Yes, there is a little heart printed instead of the lowercase s, which should have been an uppercase S anyway. The line above that reads: 570 PRINT "DIGITAL BOARD. " I look on my keyboard caps to find those two symbols and discover they really mean "digital PC board."

Oh, well! Look forward to another new, improved PET. Of course it will not be compatible with either of the two previous versions. That's my prediction. A year from now we'll see if I'm right.

If all that excitement isn't enough to give a serious PET user heart failure, Commodore finally is shipping their dual floppy-disk units. I have one, or what's left of one. I was wise and bought it through a dealer. It was less than 25 percent reliable, so I rushed it back to the store and explained how I could save a program on disk 1, but when I tried to load that same program from disk 1, it wouldn't even find it. The store had an extra unit, but it also was bad. So they tinkered with mine. I got it back in a couple of days. Now it is a single drive with a hole where the second drive should be. I'm not yet sure if the one drive I'm left with will work.

See, I told you there was excitement in store for PET users. I'll tell you a little bit about the dual-disk drive from Commodore as I promised last time. *Cursor* (Box 550, Goleta CA 93017) printed some comments on the new disk units in their issue #9. Cursor's first unit didn't work. They are on their second unit now

and are not impressed with it. According to an engineer friend of theirs, the Shugart drives that Commodore is using have been stripped of several components (to save money?).

Point A. There is no head-load solenoid, thus when the disk door is closed, the head is always loaded. A lot of friction must be overcome by the motor each time the disk is activated.

Point B. The drives do not have a micro-switch that senses when the head is retracted to track 0. Instead, you hear a nice grinding sound each time you initialize the disk. This is because they run the stepper motor as far as it will go, then time out.

Point C. They don't have an LED to sense the index hole in the diskette. How this will affect reliability remains to be seen.

The DOS leaves a lot to be desired too. For example, the disk unit is smart and knows when an error has been encountered. However, all it does is stop and light up a small LED on the front of the disk unit. No error message is printed on your screen. As a matter of fact, nothing is printed on the screen. To find out what the error was, you have to type in the following program (no, it *cannot* be done as direct commands):

```
10 OPEN 15,8,15
20 INPUT#15,A$,B$,C$,D$
30 PRINT A$,B$,C$D$
```

This has to be typed in. You can't load it in from disk because that load would cancel whatever message was there. You can load it from cassette, but if your PET is locked out, you will not be able to do that.

Those aren't the only exciting things about the Commodore dual-disk unit. Whenever you insert a diskette into a drive, you have to "initialize" it. Thus if you wish to see what is on your diskette, you must type in the following series of commands (yes, there are direct commands):

```
OPEN, 1,8,15
PRINT#1,"IO"
LOAD"$0",8
LIST
```

Isn't that fun! When working correctly, programs only take a couple seconds to load or save; but random-access programming with the unit is another story. To get random access, I typed in Commodore's sample program. It was 57 lines (including some REMark lines). All that for random access? And then it didn't work.

More on the disk system next installment. (Special thanks to Ron Jeffries, publisher of *Cursor*, for his permission to use some of his comments.)

After working with Commodore's dual-disk unit for one week, I decided to order a Computhink dual-disk unit from New England Electronics (679 Highland Ave., Needham MA 02194). Since their delivery is quick, I should have it in time to tell you about it next time. I do have their full-size keyboard now, and it works very well . . . simultaneously with the original PET keyboard. It actually hooks onto the PET to prevent it from being pulled out too far and ripping the connecting cable. It has special keys, as on the PET, but they're easier to use. There is a separate RUN key (no need to shift and hit the RUN/STOP key). Each cursor movement has its own key (four keys) and separate INSERT and DELETE keys (two keys).

Its metal cabinet matches the PET and looks very nice. The numbers are in a single row across the top, as on most typewriters. Some keys (such as the # key) are not on this keyboard, but then you simply hit that key on the PET keyboard, which still functions as usual. The price for this quality keyboard from New England Electronics is $139.95.

New Printer

Skyles Electric Works (599 Mathilda Ave. #26, Sunnyvale CA 94086) is marketing the PAL (printer on a leash) for the PET. A thermal printer using paper 4 7/16 inches wide, it prints 40 characters per line—including uppercase and lowercase—96 characters in all. Printing in both directions, it zips along at 40 characters per second. A test and demonstration tape is included, as well as over 200 feet of paper. The price for all this is $450 plus $10 shipping. The PAL comes ready to simply plug into the PET IEEE port and run.

Programmable Character Generator

Schiessl & Steiner (Augustenstr. 91/2, D-8000 Munich 40, West Germany) have announced a programmable character generator for the PET 2001. You can design your own character set of up to 256 characters using SS's comfortable interactive program. This character set can be saved on tape or diskette for future use in your programs. It can also be used to have a graphic resolution of 320×200 points (256 maximum characters). They offer machine-language routines to plot points and lines. The price is about 1,300 DM including software and tax. Delivery is 4-6 weeks. I have not seen the generator, but it sounds interesting.

8080 Simulator for the PET

J. K. Johnson (9304 Emory Grove Rd., Gaithersburg MD 20760) has modified the 8080 simulator for the 6502 by Dann McCreary (PO Box 16435-8, San Diego CA 92116) to work on the PET. (The cost of the simulator for the KIM-1 is $19.50 from Dann.) J. K. Johnson will make his adaptation available for tape cost plus $1.50 to any bona fide purchaser. Contact him for further details. He said that this 8080 simulator is so good it defies description. This program allows the PET to execute the 8080 instruction set. This is a significant step forward for the PET.

PET Firmware

What is firmware? Firmware can be referred to as software on a chip. Once the chip is plugged into your PET, it will be available whenever your PET is turned on. For example, the new PET ROMs are firmware. They include the TIM monitor for the PET as well as the PET operating system. This Commodore ROM set will soon be available to old PET owners for $50. I've heard rumblings about new chips for the PET with line renumbering, automatic line numbering and more. Next time I should know more and will let you know exactly what is included. If you are desperate, try contacting these two sources for advanced information: Skyles Electric Works (1031 Stonydale Dr., Cupertino CA 95014) or Harry Saal (810 Garland Dr., Palo Alto CA 94303).

16K PET Assembler-Text Editor

C. W. Moser (3239 Linda Dr., Winston-Salem NC 27106) is selling what appears to be an excellent PET assembler written in machine language. The price is $37 for a PET tape and very nice manual. I have a copy of it, so I know it does exist. It will be reviewed in the *PET Gazette*.

BC Computing Joins Computer Way

Computer Way (PO Box 7006, Madison WI 53707) is expanding in the personal computer field, including the PET computer market, with the BC computing staff. Readers can refer to my column in past issues of *Microcomputing* for information on BC Computing and Computer Way. Computer Way markets the highest-quality diskettes and cassette tapes, and now will soon be able to protect PET programs. They also sell quilted covers for the PET for $15. I have seen them, and they are nice.

PET Screen Transformation

Competitive Software (21650 Maple Glen Dr., Edwardsburg MI 49112) is selling light, smoke-gray Plexiglas "faces" for your PET screen. Plexi-Vue fits over the screen and surrounding formed plastic. You then have a transformed PET. The whole top looks like a screen, similar to some fancy terminals. Plexi-Vue is available for $9.95. I have one for each of my PETs. They look more professional, but they have a slight reflective problem, similar to a dull mirror.

PET Computer on Rubber Stamp

ProMark (410 Stony Battery Rd., Lancaster PA 17601) will sell you a professional rubber stamp with the PET, pictured on the left, and your name and address (three lines) for $5.75. Let the world know you have a PET. Make it part of your return address with this stamp.

PET Machine-Language Guide

Abacus Software (PO Box 7211, Grand Rapids MI 49510) is selling a manual to help the PET owner interested in machine-language programming. Over 30 of the PET's built-in routines are detailed so that the user can put them to good use. A version is available for either the old or new PETs. Price is $6.95 plus 75 cents postage. I have a copy, and it is a good starter manual.

Calculators/Computers Gone

The magazine I was very impressed with, *Calculators/Computers*, has ceased publication. Word is that their material and articles were passed on to either *Interface Age* (PO Box 1234, Cer-

(continued on page 12)

OHIO SCIENTIFIC'S
SMALL SYSTEMS JOURNAL

Introduction

This month we are continuing with part three of our discussion of information-management systems specifically dealing with OS-DMS and OS-MDMS for 8-inch floppy, Winchester disk and mini-floppy-based Ohio Scientific computer systems. We will continue the discussion with an OS-DMS utility program overview and then describe some practical uses of OS-DMS.

OS-DMS UTILITY PROGRAM OVERVIEW

Create New Master File

This program allows the user to create master files. The user specifies the file name, password, the number of records, the number of fields, the name of each field and the maximum length of each field. The system then creates and initializes the master file automatically.

Edit Master File

This program provides a means of editing master files. The user may specify a record number, an exact entry, or a search "string" to access a particular record.

Dump Master File

This program sequentially outputs records contained in the master file to either the console or printer.

Generate Mailing Labels From Master File

Applications program that prints mailing labels. The user defines the number of labels per row, the spacing between labels on the same row, and the spacing between rows. This program verifies that at least street, city, state, and zip exist in the file. If not, the program informs the user as to what information is required (i.e., street, city, etc.).

Master File Merge or Load

The merge capabilities provided by this program allow the following file manipulations:

1) The movement of selected fields from one master file to user-specified fields in a second master file.
2) Coupled merging of files where, for example, John Doe is pulled from the first file. John Doe is then located in the second file. The information contained under John Doe in the first file is then transferred to user-specified fields in the record where John Doe was found in the second file. Note that the range, i.e., from record number to record number, may be limited.

Diskette Copier

A "secretary's" diskette copy program that allows easy backup. The program automatically copies single- or double-sided diskettes.

Multi-File Multi-Format Report-Writer

This report-writer permits report generation based on information contained in up to three files. The report contents may be based on linking between files. What this means to the end user can be seen in the following example. The report is to contain the following:

Part number
Vendor's name
Vendor's address

MFMFRP may be directed to pull part numbers sequentially out of one file. That part number would then be located in a second file. The vendor's name could then be pulled from the second file and located (found) in a third file. The vendor's address could then be pulled from the third file. All of this information or selected parts of this information would then be printed out in report form.

Multi-Conditional Report Writer With Statistical Functions

This report-writer allows output to be in the vertical format or the horizontal format. Conditions may be specified so that only records meeting the conditions appear in the report, e.g., quantity in stock less than reorder level. The user also may specify the fields desired in the report. The user may also choose to have any of the fields summed, averaged, or the sum of the products calculated.

Multi-Conditional Statistical Package

STAT is a program that may perform a variety of calculations on OS-DMS master files. The records that these calculations are performed on may optionally be required to meet a set of conditions. These conditions may be, for example, city not equal to Kent and population not less than 10,000 and not greater than 500,000. The seven statistical functions that may be performed are listed below:

Summation, Average, Minimum/Maximum, Number of Occurrences, Sum of the Product, Standard Deviation, and Variance.

Sort a File

This menu function allows the user to sort either master files or key files. The file may be put in ascending or descending order based on an alphanumeric or numeric sort.

Master File Record Inserter

This program allows blank records to be inserted in OS-DMS master files. Inserting blank records is an alternative to sorting the file, and in most cases it is faster than the sorting. The user specifies where to insert and how many records to insert.

Master File Record Delete and Repack

DMS files can be packed (blank records removed) by using this program. A record is considered empty if an ^P is in the first field or all the fields are equal to zero.

Using OS-DMS

As we stated in last month's issue there are three fundamental steps in the use of the information-management system. The first is creating the file that contains the desired information, the second step is being able to edit the information stored in the file, and the third step, where we left off last month, is outputting the desired information. Let us now continue with another example of Ohio Scientific's multi-conditional report-writer, this time showing how the statistical functions may be used.

One example is a payroll earnings and deduction report, often referred to as a payroll register. This report is printed from a file containing information on only the people being paid on a particular payroll, but for those people, this file contains whatever data is needed to print paychecks and/or this report.

The operations performed by the person running the computer consist of merely answering questions that determine the format of the report, where the data is to come from, what *is to be* printed, what the headings should look like, what conditions are in effect, and what statistical functions should be

operative. From these answers the report is printed as specified. In many cases, these report-writers are used in developmental work to print the same report several times using different formats so that comparison of the resultant products may be made. When the decision is made as to which format is best, a fixed program may be easily created from the report-writer so that the operator does not have to answer the repetitive questions on each run.

For the payroll register we are using as our example, the dialogue between the operator and the computer will consist of the following questions and answers:

CONSOLE OR PRINTER ? P
SINGLE OR DOUBLE SPACED REPORT ? S
VERTICAL OR HORIZONTAL FORMAT (V OR H) ? H
KEY FILE OR MASTER FILE ACCESS ? M
DEVICE MASTER FILE IS STORED ON ? A
MASTER FILE NAME, PASSWORD ? K
?? PASS
ENTER REPORT HEADING ? EARNINGS AND DEDUCTIONS REPORT 5/15/79

```
**************************************************
*  ALL FIELD NAMES WILL BE DISPLAYED WITH THEIR  *
*  FIELD NUMBER                                  *
*  SPECIFY IF A PARTICULAR FIELD SHOULD APPEAR ON*
*  THE REPORT                                    *
*  BY ENTERING A '↑' FIELD NUMBER FOR EACH FIELD. IF*
*  YOU WANT                                      *
*  ALL THE FIELDS IN A FILE PRINTED ON THE REPORT IN*
*  THE SAME                                      *
*  ORDER THEY APPEAR IN THE FILE, TYPE THE WORD 'ALL'*
*  INSTEAD                                       *
*  OF '↑' FIELD NUMBER. <<NOTICE>> ENTER THE FIELD*
*  NUMBERS IN                                    *
*  THE ORDER YOU WISH THE FIELDS TO BE PRINTED ON*
*  THE REPORT!                                   *
**************************************************
```

1) NAME
(2) EMPLOYEE NUMBER
3) REGULAR HOURS WORKED
(4) OVERTIME HOURS WORKED
5) PAY PER HOUR
(6) REGULAR PAY
7) OVERTIME PAY
(8) COMMISSIONS
9) OTHER PAY
(10) FICA DEDUCTION
11) FEDERAL INCOME DEDUCTION
(12) STATE TAX
13) LOCAL TAX
(14) INSURANCE DEDUCTION
15) OTHER DEDUCTIONS
↑1↑3↑5↑6↑10↑11↑12↑13↑-

DO YOU WISH TO CHANGE ANY HEADINGS (Y OR N) ? Y
DO YOU WISH TO CHANGE HEADING # 1 :NAME ? N
DO YOU WISH TO CHANGE HEADING # 2 :REGULAR HOURS WORKED ? Y
ENTER NEW HEADING ? REG HRS
DO YOU WISH TO CHANGE HEADING # 3 :PAY PER HOUR ? Y
ENTER NEW HEADING ? HRLY A__PAY
DO YOU WISH TO CHANGE HEADING # 4 :REGULAR PAY ? Y
ENTER NEW HEADING ? REG PAY
DO YOU WISH TO CHANGE HEADING # 5 :FICA DEDUCTION ? Y
ENTER NEW HEADING ? FICA
DO YOU WISH TO CHANGE HEADING # 6 :FEDERAL INCOME DEDUCTION ? Y
ENTER NEW HEADING ? FEDERAL
DO YOU WISH TO CHANGE HEADING # 7 :STATE TAX ? Y
ENTER NEW HEADING ? STATE
DO YOU WISH TO CHANGE HEADING # 8 :LOCAL TAX ? Y
ENTER NEW HEADING ? LOA__CAL
HOW MANY CONDITIONS DO YOU WISH TO SET (0>4) ? 0
DO YOU WISH TO GENERATE ANY STATISTICAL INFORMATION ? Y
ENTER THE SELECTIONS WHICH YOU WOULD LIKE TO SUM
IF NONE, SIMPLY HIT THE RETURN KEY

(1) NAME	(2) REG HRS
(3) HRLY PAY	(4) REG PAY
(5) FICA	(6) FEDERAL
(7) STATE	(8) LOCAL

ENTER YOUR SELECTION(S)
?↑2↑4↑5↑6↑7↑8

The report generated by this program appears as follows:

For another type of output, the OS-DMS multi-file multi-format report-writer generates reports based on information contained in up to three files. For instance, a real estate agency might have a location file that contains a brief description of all the nearby cities in which they have listings, along with a listing file that contains a description of the current real estate available for sale. The contents of these files could be as shown below:

Location File	Listing File
City	Owner
Population	Street
Schools	City
Taxes	Rooms
	Bedrooms
	Price

Whenever the agency interests a person in buying real estate, it simply generates the multi-file report-writer with these two files to obtain a copy of all the listings within the stated price range, along with a brief description of the city in which they are listed. The multi-file report-writer is a convenient utility, which permits the user to generate a vertical or horizontal formatted report that may contain a collection of information from up to three files. Normally, to obtain such a collection of information, the user would have to generate two or three separate reports, thus involving time and additional paper to keep track of.

Note: Each file must contain the same contents in the key field. That means the contents of a key field must also be found in the field to be keyed on in other files. This means that the city field of the location file must contain the same names of the cities as the listing file.

EARNINGS AND DEDUCTIONS REPORT 5/15/79 PAGE 1

NAME	REG HRS	HRLY PAY	REG PAY	FICA	FEDERAL	STATE	LOCAL
BROWN JAMES	25	3.75	93.75	5.75	.04	.34	.94
CLARK WILLIAM	.5	3	1.5	.09	0	0	.02
MORRIS DAVID	22.75	4.25	96.69	5.93	.48	.36	.97
STEVENSON KAREN	13	3.00	39.00	2.39	0	.20	.39
THOMPSON PHIL	4	3.25	13.00	.00	0	.07	.13
JOHNSON HENRY	8.5	5.25	44.62	2.74	0	.10	.45

SUMMATIONS

REG HRS	REG PAY	FICA	FEDERAL	STATE	LOCAL
73.75	288.56	17.7	.52	1.07	2.9

CONSOLE(C) OR PRINTER(P) OUTPUT ? P
VERTICAL(V) OR HORIZONTAL(H) FORMAT ? V
OS-DMS MULTI-FILE REPORT WRITER

DO YOU WISH TO USE 2 OR 3 FILES (2 OR 3)? 2
ENTER REPORT HEADING ? CENTRAL REALTY WORLD 6/1/79
DEVICE MASTER FILE # 1 STORED ON ? A
MASTER FILE NAME # 1, PASSWORD ? CITYS,PASS

```
**********************************************************
* ALL FIELD NAMES WILL BE DISPLAYED WITH THEIR FIELD NUMBER,  *
* SPECIFY IF A PARTICULAR FIELD SHOULD APPEAR ON THE REPORT   *
* BY ENTERING A '↑' FIELD NUMBER FOR EACH FIELD. IF YOU WANT  *
* ALL THE FIELDS IN A FILE PRINTED ON THE REPORT, TYPE THE    *
* WORD 'ALL' INSTEAD OF '↑' FIELD NUMBER.                     *
* <<NOTICE>> THE ORDER IN WHICH THE FIELDS WILL APPEAR ON THE *
* REPORT MAYBE ARRANGED LATER IN THE PROGRAM!!!               *
**********************************************************
```

ENTER A C TO CONTINUE ? C
(1) CITY (2) POPULATION
(3) SCHOOLS (4) TAXES
'↑' FIELD # OR KEY LABEL FROM FILE 1 ? ↑1
ENTER '↑' FIELD # FOR EACH FIELD YOU WISH TO APPEAR ON THE REPORT
? ↑1↑2↑3↑4
DEVICE MASTER FILE # 2 STORED ON ? B
MASTER FILE NAME # 2, PASSWORD ? REALI,PASS
(1) OWNER (2) STREET
(3) CITY (4) ROOMS
(5) BEDROOMS (6) PRICE
'↑'FIELD # OR LABEL TO BE KEYED ON IN FILE 2 ? ↑3
ENTER '↑'FIELD # FOR EACH FIELD YOU WISH TO APPEAR ON THE REPORT
? ↑1↑2↑4↑5↑6

CENTRAL REALTY WORLD 6/1/79 PAGE 1

OWNER	SMITH
STREET	123 ANYSTREET
CITY	KENT
POPULATION	85000
SCHOOL RATING	FAIR
TAX RATE	56
ROOMS	11
BEDROOMS	4
LISTED AT	99000
OWNER	KARSON
STREET	33 THIRD
CITY	RAVENA
POPULATION	44000
SCHOOL RATING	BAD
TAX RATE	44
ROOMS	6
BEDROOMS	2
LISTED AT	39000
OWNER	ROBERTS
STREET	12 FOREST
CITY	AURORA
POPULATION	12000
SCHOOL RATING	GOOD
TAX RATE	63
ROOMS	8
BEDROOMS	2
LISTED AT	89000
OWNER	MARTIN
STREET	53 WOODSIDE
CITY	MANTUA
POPULATION	4000
SCHOOL RATING	FAIR
TAX RATE	50
ROOMS	8
BEDROOMS	3
LISTED AT	62500

For comparison of horizontal and vertical formatting, the following run produces the same information as above. Based on the format, however, it is easier to key on specific items, though perhaps not as many items may be presented for each listing (if the records have too many fields to place in the print area).

```
CONSOLE(C) OR PRINTER(P) OUTPUT ? P
VERTICAL(V) OR HORIZONTAL(H) FORMAT ? H
OS-DMS MULTI-FILE REPORT WRITER
DO YOU WISH TO USE 2 OR 3 FILES (2 OR 3)? 2
ENTER REPORT HEADING ? CENTRAL REALTY WORLD 6/1/79
DEVICE MASTER FILE # 1 STORED ON ? A
MASTER FILE NAME # 1, PASSWORD ? CITYS,PASS

**********************************************************
* ALL FIELD NAMES WILL BE DISPLAYED WITH THEIR FIELD NUMBER,  *
* SPECIFY IF A PARTICULAR FIELD SHOULD APPEAR ON THE REPORT   *
* BY ENTERING A '↑' FIELD NUMBER FOR EACH FIELD. IF YOU WANT  *
* ALL THE FIELDS IN A FILE PRINTED ON THE REPORT, TYPE THE    *
* WORD 'ALL' INSTEAD OF '↑'FIELD NUMBER.                      *
* <<NOTICE>> THE ORDER IN WHICH THE FIELDS WILL APPEAR ON THE *
* REPORT MAYBE ARRANGED LATER IN THE PROGRAM!!!               *
**********************************************************

ENTER A C TO CONTINUE ? C
(1) CITY              (2) POPULATION
(3) SCHOOLS           (4) TAXES
'↑'FIELD # FOR EACH FIELD YOU WISH TO APPEAR ON THE REPORT***
?↑3↑4
DEVICE MASTER FILE # 2 STORED ON ? B
MASTER FILE NAME # 2, PASSWORD ? REALI,PASS
(1) OWNER             (2) STREET
(3) CITY              (4) ROOMS
(5) BEDROOMS          (6) PRICE
'↑'FIELD # OR LABEL TO BE KEYED ON IN FILE 2 ? ↑3
***ENTER '↑'FIELD # FOR EACH FIELD YOU WISH TO APPEAR ON THE REPORT***
?↑1↑2↑3↑6

**********************************************************
* THE FIELD(S) THAT WILL BE DISPLAYED AFTER THIS PARAGRAPH ARE *
* THOSE WHICH WERE CHOSEN TO APPEAR ON THE REPORT. ENTER '↑'   *
* FIELD # OF ANY OR ALL OF THE FIELDS IN THE ORDER THEY SHOULD *
* APPEAR ON THE REPORT. IF YOU WANT ALL OF THE FIELDS TO BE ON *
* THE REPORT, IN THE SAME ORDER THEY ARE IN NOW, TYPE THE WORD *
* 'ALL' INSTEAD OF '↑'FIELD NUMBER.                            *
**********************************************************

ENTER A C TO CONTINUE ? C
(1) SCHOOLS           (2) TAXES
(3) OWNER             (4) STREET
(5) CITY              (6) PRICE
?↑3↑4↑5↑1↑2↑6
DO YOU WISH TO CHANGE ANY HEADINGS (Y OR N) ? N
```

The report generated by this program appears as follows:

CENTRAL REALTY WORLD 6/1/79 PAGE 1

OWNER	STREET	CITY	SCHOOLS	TAXES	PRICE
SMITH	123 ANYSTREET	KENT	FAIR	56	99000
KARSON	33 THIRD	RAVENA	BAD	44	39000
ROBERTS	12 FOREST	AURORA	GOOD	63	89000
MARTIN	53 WOODSIDE	MANTUA	FAIR	50	62500
BROWNE	34 WINDSOR	HUDSON	GOOD	44	99500
SUMMERS	98 THOMPSON	AKRON	POOR	48	81500
SNYDER	23 EDGEWOOD	STREETSBORO	POOR	44	85900

In the next issue, we will continue our exploration of features of OS-DMS.

PET-POURRI

(from page 7)

ritos CA 90701) or *Computing Teacher* (Computing Center, Eastern Oregon State College, La Grande OR 97850). I am sorry to see it go.

Software for Schools

Microphys (2048 Ford St., Brooklyn NY 11229) has announced over 90 programs on cassette for the old PET: in chemistry, physics, math and vocabulary for junior and senior high-school use. A limited number will also be available from Commodore.

Microcomputer-Industry Trade Association

MITA (345 Sweet Road, Woodside CA 94062) is just what the microcomputer market needs. Both the consumer and the manufacturer or dealer will benefit. The organization has just started but is rapidly growing. I hope membership in this association will be a sign of a responsible company. Two of the association's present members are in the PET market: Connecticut Microcomputer and the *PET Gazette*. Other PET companies should join this organization.

PET Shirts

High-quality colored T-shirts are available from Computer Way at only $5.95 per shirt. Both children and adult sizes are available. Every proud PET owner should wear one, especially to PET club meetings. Several different PET designs are available. Your name can be included for a slight additional charge.

PET Reference Book

Channel Data (5960 Mandarin Ave., Goleta CA 93017) has come out with the second edition of their *Channel Data Book*. It is a vast improvement over the first edition and would be a worthwhile addition to every PET owner's library. For $20 you receive a high-quality 3-ring binder filled with listings of PET companies and their software and hardware. Since it is organized by category, it is easy to use and very helpful.

```
0 INPUT "[CLR]STARTING LINE NUMBER  100[ 5 LEFT]";NL:INPUT "INTERVALS OF  10[ 4 LEFT]";IV
1 PRINT "[HOME][ 28 DOWN]";:PT=PEEK(50003)
2 PRINT "[HOME][ 18 DOWN]";:FOR X=1 TO 4:PRINT "                                    ":NEXT
3 PRINT "[HOME][ 21 DOWN]";NL;:POKE 525-PT*367,0
4 GET A$:IF A$="" GOTO 4
5 PRINT A$;:IF ASC(A$)<>13 GOTO 4
6 PRINT "ONL="NL+IV":IV="IV:PT=PEEK(50003):PRINT "RUN[HOME]
7 PRINT "[HOME][ 17 DOWN]";:POKE 525-PT*367,5:FOR X=527 TO 531:POKE X+PT*96,13:NEXT X:END
```

Automatic line numberer program. (First character after first quotes in line 6 is a zero.)

Unique Programs

I have a copy of Toker, an example of the best animated graphics presently available. This game is especially hilarious if you understand the program's name. Although the programmer wishes to remain unknown, this top-quality, challenging program is a good example of how several different things can be animated simultaneously in real time on the PET screen. I hope it will be available soon in the planned Alternative Game Pak from the *PET Gazette*.

An alternative game from England is called Trees. This non-violent game attempts to have action with graphics, without anyone being zapped or killed. One person plays, trying to bring enough food and love to two trees so that they grow and blossom. This game is slated for inclusion in the Alternative Game Pak.

If you didn't make it to Harrisburg, and you're a nihilist at heart, try Nuclear Reaction, being introduced by *Creative Computing* (PO Box 789-M, Morristown NJ 07960) (it is one of six programs on Graphics Games-2 selling for $7.95). In this two-player game, each player tries to start chain-reaction explosions. To win you must "blow up" the entire board displayed on your screen. If you don't want to grow trees, you can "glow" them.

Hunt Distribution Delays Gone

Hunt is a sophisticated and flexible game for the PET. It will run on both the old and new PETs. The *PET Gazette* was going to help distribute this series of programs, but was so swamped with work that distribution was delayed. This problem was finally solved when Computer Way entered the PET market. The *PET Gazette* has put together Hunt Pak 1, which includes Hunt (the game structure program), Huntwriter (the program that allows you to create new Hunt game data tapes easily) and several sample game data files. Computer Way will distribute Hunt Pak 1 for the *PET Gazette*. As with all *Gazette* Pak series tapes, the cost is only $10 per Pak. Visa and Master Charge are accepted by Computer Way. Please don't order Hunt from the *Gazette*; it only will add long delays to your order.

Automatic Line Numbering

Readers have requested that I print the listing for a program to provide automatic line numbering as an aid while keying in a BASIC program. The program as listed should work on both old and new PETs. This program is only eight lines long and allows the last five lines keyed in to be seen. Although some lines appear to be too long, if compactly keyed in they do fit onto two lines.

Please address any correspondence to: Len Lindsay, *PET Gazette*, 1929 Northport Dr., Rm. 6, Madison WI 53704.

BOOKS

Digital Design with Standard MSI and LSI
2nd ed., Thomas Blakeslee
Wiley-Interscience, Somerset NJ
Hardbound, 400 pages, $17.50

As you might expect, this book has an early chapter devoted to conventional Boolean logic and combinational circuit logic design. This includes minimization of the number of gates to accomplish a circuit function.

However, as a prelude to this Boolean logic exercise, the author introduces the concepts most important to the industry in designing a product: to minimize the package count and not necessarily the gate count. Blakeslee calls the various types of MSI and LSI circuits "black boxes," which perform complex functions within their boundaries, and we can design products in a block-by-block structure. For each block, we decide on the output we desire. Then we can select the device that will give us the desired output for the given input.

To aid us in minimizing package count Blakeslee offers novel ways multiplexers and decoders may be used to fulfill complex combinational logic equations. He follows this with sequential logic examples of an even sequence control in both gate-for-gate design and an equivalent, elegantly simple MSI implementation using multiplexers to minimize the package count.

This leads to the introduction of the microprocessor as a programmable logic element able to perform many different logic functions without having to physically reconfigure the logic elements. The machine-language instructions are kept in the memory to tell the multi-use logic elements how to handle the input signals.

As a follow-up to the microprocessor section, Blakeslee touches on assembly-language programming, assemblers, PL/M, and briefly explains the concept of microprogramming as compared to assembly-language coding.

ESFOA Newsletter

Secretary, Fred Waters

Well, you say, what's an ESFOA? EXATRON STRINGY FLOPPY OWNERS ASSOCIATION. The Stringy Floppy is a fast reliable mass storage subsystem for microcomputer programs and data. ESFOA is an intensively active users group whose members devise and exchange ideas, software, hardware, and anything else that will increase the skill and fun of using their systems in general, and the Stringy Floppy in particular.

The TRS-80 model of the ESF was introduced at the 4th Computer Faire in San Francisco, May 11. The S-100 model was introduced at the Second Computer Faire in San Jose a year ago, and the SWTP version has just been placed on the market. More on these others later. Look at the photo above. If you add a flat cable for a connection into the back of the TRS-80, and a small sealed-unit power supply for the AC outlet, you have the TRS-80 model.

This remarkable peripheral for your TRS-80 will load a 4K-byte program into memory in 6 seconds. The small tape wafers that store this material insert into the slot in the front of the module pictured above. They contain a 5-foot continuous loop of digital-quality magnetic tape. Data density is 80 9-bit bytes per inch; transport speed is 10 ips; and the baud rate is 7200.

How did all this good stuff get into the tape wafer in the first place? You loaded it from memory using the Stringy Floppy and a new tape wafer. Complete users instructions for the ESF are:

1. After entering 'SYSTEM' in your Level II BASIC, type '/12345' and touch the ENTER key.
2. To save contents of RAM, type '@SAVE', then 'ENTER'.
3. To load into memory, type '@LOAD', then 'ENTER'.

That's it! These two commands are now in your Level II command table, and can be used as needed.

If you have a longer program than 4K, the 10-foot wafer will save or load 8K in 12 seconds, the 20-foot wafer will save or load 16K in 24 seconds, and so on. If you need it, there is a 50-foot wafer and a 75-footer, with proportional higher capacities.

This is the first issue of the ESFOA Newsletter to be published in Kilobaud Microcomputing. This way we can reach the widest possible range of ESF users to keep them informed of software development using the ESF, techniques for getting the most use out of their systems, and system extensions; and at the same time let others know about this remarkable subsystem. We intend also to address current and new owners of the S-100 ESF, as well as the SWTP model, and down the road, the PET and Apple models.

Probably the most remarkable feature of the Exatron Stringy Floppy is its reliability. Yours truly demonstrated it almost continuously for three days at the Computer Faire, and the only time without exception that it didn't work perfectly was when I typed "@SQVE" instead of "@SAVE". I can tolerate that! Every part of the ESF design and operation is to industrial digital tape standards. Control is entirely in the firmware, a 2716 EPROM. There are no switches or controls—the only physical handling is the insertion or withdrawal of the wafer you select. The tape, the recording technique, and all the electronics are selected and designed for digital data storage and retrieval. IT REALLY WORKS GREAT!

A provocative observation at the Faire: we talked to quite a few TRS-80 owners who were methodically going up and down the aisles pricing every disk system in sight. When they got to the Exatron booth and saw the Stringy Floppy in action, they—and we—realized that they didn't really need or want a disk. They just wanted to get away from audio tape recorders and audio tapes!

Did you see that article in the May 14 issue of the Wall Street Journal? Mitchell Lynch, a staff reporter, was provided with a TRS-80 by the WSJ to get the experience on which to base an article. He was considered "typical" as to family status, and also didn't like to program. He told what he did with the computer over several months, and some of the problems he had. There's no question that much of the negative side of the picture arose out of the difficulty of using a cassette recorder, with audio design standards, audio-quality tape, and audio knob adjustments to make. (He never commented on his reaction to the time required to load program material at 500 baud.) His conclusion: "Today's home computers require a lot of fooling with."

Several TRS-80 users at the Faire asked, "How do I connect the Stringy Floppy to my bus connector? I already have a printer connected there." The solution to that problem is the Exatron BUS-EX. The BUS-EX is a 40-pin connector cable with a female connector for the back of your TRS-80 (or Expansion Interface), and two male bus connectors so you can plug in two peripherals. If you need more than two bus connectors—say for multiple Stringy Floppys—you can order a 3-for-1 or a 4-for-1 BUS-EX.

Did you know that ESFOA has met for the Saturday morning workshop at the Exatron plant every week since January 1978? Well it has. Coffee, a large round table both figurative and literal, and friendly help from other members are always available. If you live in the Bay Area or visit there, come by on any Saturday morning between 9 and 11, to 3555 Ryder St., Santa Clara.

This association of professionals, hobbyists, and beginners is an invaluable fringe benefit of owning and using the Stringy Floppy. Owners of the S-100 model started out this way last year, and the results have been astounding. That version of the Stringy Floppy now has a very efficient easy-to-use Utility Package; a concise, beautifully-documented monitor–ESFMON–for both tape routines and stand-alone monitor functions; a 4K Tape Operating System-ESFTOS –which supports multiple named files on one tape, multiple drives, general-purpose I/O routines for all popular system configurations, and other DOS-like features; and many other fine programs including linking loaders, a CP/M-compatible operating system, and some highly useful improvements to standard assemblers. No reason in the world why the collective efforts of TRS-80 owners using the Stringy Floppy won't go the same way!

HOW TO ORDER

The Exatron Stringy Floppy for the TRS-80 is assembled and tested, and is covered by a 30-day moneyback guarantee and a one-year full warranty. Within seconds of turning on your TRS-80, your ESF is up and running. The ESF is $249.50, and a box of 10 wafers, 5-ft., 10-ft., or 20-ft., is $20.00. The BUS-EX is $15.00. All prices include shipping and handling; CA residents add tax. To order fastest, call our toll-free number and give us your MasterCharge or Visa number.

If you have any questions about these products, about Exatron, or about ESFOA, call the HOT LINE. Address letters to ESFOA, 3557 Ryder St., Santa Clara, CA 95051.

OUTSIDE CALIFORNIA **HOT LINE**

800-538-8559

Finally, concluding chapters cover time-sharing of logic elements through multiplexing, methods of data transmission and characteristics of certain types of I/O and storage devices.

Generally speaking, I consider this book a significant self-teaching tool for someone interested in logic design. The text is well organized and readable, even for a beginner, and stays away from heavy math or theory. It is also inspirational because it allows you to "discover" that there is more than one way to accomplish the desired result.

Digital Design encourages you to keep up with what functions are available in MSI and LSI. When an application arises, this knowledge will come in handy, simplifying the design, decreasing the debug time (fewer lines and functions to check out), improving the reliability (fewer packages means less chance for human error in assembly and fewer assembly steps) and putting your working product or project into its intended application more quickly.

At $17.50, the price of this book is well below the average $25 digital-engineering text, and, considering its value as a practical learning tool, it is money well spent. This second edition is 43 pages longer than the 1975 edition and offers an expanded section on microprocessors and their support circuitry.

As these components mature, they will probably (as predicted by numerous authors) become the generalized logic design elements of the future. The knowledge and approach toward a black-box design concept, which this book provides, should prove useful to the practicing designer and hobbyist in the future.

Robert A. Peck
Sunnyvale CA

How You Can Learn to Live with Computers
Harry Kleinberg, Penguin Books
ISBN 01400.49703
Softbound, $2.95

Being in two fields, broadcasting and computering, that are constantly bombarded by technological change, I often find myself caught up in that change so much that I forget the social implications involved. Judging from the titles of the books that pass over my desk, so do most of the authors who write about these two changing fields.

Once in a while, then, it's nice to come across something that takes you back to a broader view of technology. I've heard so many numbers lately, I'm not sure what the differences are between an 8085 and an 8080A; when I sit down to do assembly-language programming I can't remember if LXI A, 01 is an 8080 or 6502 mnemonic; in short, future shock is starting to blur my mind.

Harry Kleinberg's book, *How You Can Learn to Live with Computers,* put an end to all my troubles, at least for a week. Rather than dealing with 1s and 0s at length, Kleinberg gets the technical aspect out of the way fast—all the computer really does is look to see which way the switch is set, on or off. True, the computer ends up having a lot of those switches (quick, what's $8 \times 32 \times 1024$?), but still, the actual act of programming is little more than that of a switchman who chooses which way to have a train go at any fork.

Most of Kleinberg's book is about the rationale that goes behind deciding which way to throw the switch, and how it's quite possible to throw the switches correctly, but for the wrong reasons.

In order to really make his point, Kleinberg goes all the way back to ancient Greece and my favorite quotable notable: Aristotle. Aristotelian logic really is essential to computers; consider for a moment the following syllogism:

1. All engineers are brilliant
2. Caliban is an engineer
3. Therefore, Caliban is brilliant

In computer terms, point 1 above is ANDed with point 2. If the result is positive, point 3 is correct. Therefore, according to Kleinberg, if you threw the switches to positive for points 1 and 2, a computer would have to conclude point 3. Ah, but who decides whether those first two premises are true or not? Certainly not the computer. Therefore, we quickly find that Kleinberg has dismissed the computer as a simple machine and has designated the programmer as the important ingredient. One of the most important things that can be learned about computing from this book is that we feed *solutions* into the computer, not problems.

I should be careful not to give you an erroneous impression. This book is not just a treatise on logic. Kleinberg somehow manages to introduce the reader to Boolean algebra, 9's complements, digital circuitry and a myriad of other computer-related mathematics that go far beyond what Aristotle ever imagined. Not only that, but he does so with a wit and fluidity that defy attempts to put the book aside.

Nor is mathematics the only topic of interest discussed here. *How You Can Learn to Live with Computers* is probably one of the best essays on intelligence I've ever come across. What constitutes intelligence? Is the computer intelligent? Will the computer become intelligent? All these topics are discussed at length by Kleinberg.

For instance, how does emotion play a part in intelligence? Kleinberg gives the example of an engineer who came to work for RCA. This engineer spent the better part of his first day on the job poring over numbers and a calculator. Everyone thought he was working on something of great importance to the project; instead he was determining a formula by way of which he could determine the best method for getting to work (the formula is $F=(t-6:00)/T * C * d$, by the way; I'll leave the details to those who read the book). After he figured that driving was the best method, everyone thought that he would be driving to work. But wait, emotion hadn't played its part: the engineer then proceeded to come up with another formula because he preferred to take the train!

What does the above anecdote have to do with computers, you ask? Well, if you have to ask, then I urge you to read the book.

Even now I'm not through telling you what's in this little book (3×6 inches, 216 pages). To tell you the truth, I'm not sure I could possibly do it justice in the short confines of this review. To give you an idea, however, I'll tell you that, besides emotion, intuition, combinations of memory intuitions and modeling all play a part.

But what of the poor computer? A few paragraphs ago I told you that all the computer did was take your solution and restate it. Why are computers such a menacing threat to our society? Why are those computerized bills always wrong? Why doesn't the computer respond to my request for a refund? Why, why, why? I think in the end it all coalesces into a big: WHO'S WRITING THE PROGRAMS? I think Kleinberg would agree with me.

In closing, I'd like to shift gears for a second. I teach several exceptionally talented elementary-school children about computers. We all sit around some Radio Shack computers for a couple hours a week and write programs and talk equipment, programs, numbers, algorithms and the like. After reading this book and using it in connection with my work with these children, I suddenly realized that computer literacy has nothing to do with sitting in front of a computer. Nor does it have anything to do with writing a program.

What we're failing to keep in mind as we attempt to keep up with the overwhelmingly fast changes in computing is that these are machines, and it doesn't make one iota of difference whether we're using a CDC 6600 or a KIM-1 computer; *we're* what's important and we'd better never lose sight of that. It's really amazing how quickly we keep forgetting the adage of "garbage in, garbage out" (GIGO), but it's even more amazing how quickly we've forgotten *why* the phrase was coined in the first place.

How You Can Learn to Live with Computers is a required text for all computer users, as far as I'm concerned. We need to step back and look at the whole once in a while. That Kleinberg writes like a first-class novelist certainly helps one digest his message. At $2.95, this has to be the cheapest essential component of every computer user's equipment.

Thom Hogan
Bloomington IN

BASIC Programming for Scientists and Engineers
Wilbur N. Hubin
Prentice Hall, Inc.
Englewood Cliffs NJ
1978, $10.95

If you are science oriented and looking for a book to use as a text for learning BASIC, either by self-study or in a classroom, this book is a good bet. It combines a thorough instruction of the basics of BASIC with a touch of humor and many program examples and practice problems. The title indicates the book is for scientists and engineers, but don't let that scare you. Anyone with a high-school advanced-math education and a touch of calculus could understand 90 percent of the problems, flowcharts and programs.

The book is written in four sections. The first section explains the BASIC language, what each of the instructions does, and gives pointers on the best way to use the language to write efficient, bug-free programs.

The second section covers flowcharting principles. It explains and demonstrates why a flowchart should be written

Instant Software™

NEWS RELEASE

Instant Software Inc., Peterborough, New Hampshire 03458 603-924-7296

CAI BREAKTHROUGH FOR THE TRS-80*

Instant Software of Peterborough, NH, has just released an exciting, effective program for computer-assisted instruction using the Radio Shack TRS-80 16K Level II microcomputer.

The program, TEACHER, uses the technique of positive and immediate reinforcement, a method long praised by leading educators as most effective in conveying new information and fostering the early development of sound study habits.

Since TEACHER uses questions and answers input by the instructor, the program can be used to present information or to quiz on virtually any subject. A special program feature automatically formats questions using repetitive phrases, greatly simplifying data entry. True or false tests may also be given.

Although TEACHER is the perfect learning tool for people of all ages, several outstanding program features make it exceptionally well suited for younger children. At the instructor's discretion, TEACHER can: allow students to review questions and answers prior to testing; prepare and offer up to three "hints" per question and, in the event of a perfect score, display any one of three graphic rewards, including: bursting cannons, shooting stars, and hook-and-title type congratulatory messages.

The TEACHER package also contains a separate program, TEACHER DATA TRANSFER, which allows several individual tests to be combined sequentially on a single cassette, thereby permitting whole lessons to be loaded and executed with ease by even the youngest students.

*A trademark of Tandy Corporation

Remember the flash cards you used to use in school? They've helped to educate generations of students with their distinctive manner of presentation and immediate feedback.

Instant Software has taken the best elements of that style of teaching and added features made possible only through computers to come up with the most versatile educational tool in existence for owners of the TRS-80. With a simple change of cassettes your computer can help your children with their math, history, or English homework one minute, and help you learn a foreign language or brush up on those technical terms the next. TEACHER is a natural in the office environment, too, where it can help keep your salesmen and order clerks up to date on a new product line or let your visitors know a little more about your company . . . in a way they're sure to remember.

Furnished complete with the DATA TRANSFER program, blank data cassette, and detailed instruction for use, TEACHER is one piece of software no TRS-80 owner should be without. Together with your computer, TEACHER will make you, your family, and maybe even your employees a little better informed, a little more interesting . . . a little more knowledgeable than they were before. After all, what more can you ask from your computer?
Order No. 0065R $9.95

(To order use coupon on page 89)

before a program, then gives about a half dozen good flowchart examples of programs that might be found in a math program package.

"Programming for Science and Engineering," the third section, simply gives many examples of programs that might be used by scientists and engineers. There is not much instruction in this section. It is meant for the reader to learn by example, and the examples given are good ones. Some of the problems covered are: roots of equations, least-squares curve fits, numerical solutions to differential equations and errors and error studies. An extensive list of references is included in this section.

The fourth section consists of about 40 different problems that are effectively solved by a computer. These problems are taken from engineering and physics, but most of the physics is already done. All the reader needs to do is turn the equations into flowcharts and programs.

As you can tell by the title, this book is heavy on engineering and science, and offers little more than BASIC and flowcharting instruction for people interested in games, business or control applications. As an engineer, however, I found it interesting, very educational and well written.

This 8½ × 11-inch paperback is clearly printed (the type is professionally set, not copied from an 8 × 10 matrix printer printout) on quality paper. There are numerous clear illustrations, especially in the problems section. Its four appendices make this book serviceable as a handbook, although the index is not very detailed.

I highly recommend this book to anyone with a science background who is interested in learning BASIC or just looking for many good programs.

Mark K. Boyd
Lexington KY

Master Handbook of Digital Logic Applications
William L. Hunter
Tab Books
Blue Ridge Summit PA
1976, 390 pages

I originally purchased this publication as a teaching tool to assist in understanding the true nature of ac and dc noise and how it interacts with digital IC logic. It met those expectations and provided much more.

The handbook is divided into eight chapters. Chapter 1, "Understanding Digital Logic," is a review of the six basic switching operations, various flip-flops and counters, half and full adders and voltage-controlled multivibrators. Also covered are a few exotic applications of TTL such as audio frequency comparators, frequency synthesizers and a motor speed control.

Chapter 2, "Noise Immunity: CMOS vs Bipolar Logic," covers various types of noise, common methods of protecting logic circuitry from it and acceptable tests performed to determine how "noise immune" a particular logic family is. Specific topics in this chapter include noise sources, noise precautions, noise specifications and noise immunity tests. Simple equations have been provided to enhance explanations of noise margins and to supply a useful tool whereby the designer can calculate noise margins with parameters provided in data sheets for a particular logic family.

Chapter 3, "Discrete Logic and Special Logic Techniques," consists of specialized needs in logic design and unusual logic functions using packaged discrete transistors. Subjects explored entail fundamentals of current-mode logic, clock drivers, initial design work, low-power circuitry, error detection and correction, pulse-handling techniques and digital filter techniques, to mention a few.

Chapter 4 discusses "High-Threshold Logic," its basic operations and applications with a particularly thorough aspect of HTL logic flip-flops.

Chapter 5, "Field Effect Transistors: Theory and Logic Application," examines mechanical descriptions, electrical characteristics and digital applications of junction FETs and metal oxide semiconductor FETs.

Chapter 6, "Emitter-Coupled Logic Operation," provides insight into the capabilities of various ECL logic families and their applications and operations. Particular attention is given to the understanding of ECL data sheets, and a table for definition of terms unique to ECL is provided.

Chapter 7, "Emitter-Coupled Logic Interconnection Techniques," presents information necessary to construct a reliable high-performance ECL system using IC devices.

Chapter 8, "High-Frequency Digital Applications," is devoted to the examination of some actual working circuits that appear in typical system and subsystem applications.

Graphs, schematics, truth tables, block diagrams and mil-spec logic diagrams are provided throughout the text to clarify the information presented.

In summary, this handbook is not suggested for the novice computer hobbyist as it extends beyond basic electronic and basic digital logic theory. However, it is a must for the *truly* serious hobbyist, student, engineer and technician seeking information in the application and design of digital logic systems.

The only criticism I can make is that the economy of the binding material couldn't bear up under the pressure of the first day's reading.

Kent L. Karrer
Seattle WA

COMPUTER CLINIC

I have a TRS-80 and a Heathkit H14 line printer. I must now run my TRS-80 through an RS-232 interface to the H14's RS-232 interface (parallel to serial to serial to parallel). The H14 uses a 3870 CPU, and I would like to run from my TRS-80 printer port right to the printer's CPU (parallel to parallel); this would save the use of two RS-232s and the software to drive them.

I am just getting into computers and don't have the knowledge to do this, so any information you could give me would be helpful. This might make a good article for your magazine, as there are many people with TRS-80s, and the Heathkit H14 printer is good, inexpensive and easy to build.

Glen A. Jenkins
HQ. Co. 1BN. USAISD Bx 357
Fort Devens MA 01433

The "(Con)text" program input problem referred to by Louise Frankenberg in the June 1979 Computer Clinic is common to various Microsoft implementations of BASIC in that a colon or comma is used as a string delimiter. Specifically, in the TRS-80 Level II, the corresponding locations for these two characters are 223CH and 223FH, where they are loaded in the D and B registers prior to calling a string-scanning routine. Since this portion of code is in ROM, it cannot be modified by a simple POKE command. Fortunately, however, there is an easy solution. Start the input of any line containing a colon or comma with a quotation mark (which is ignored).

Roger L. Pape
7545 Marble Drive
Liverpool NY 13088

I am considering adding an IBM Model 50 electronic typewriter for general business use and would like to be able to hook it up to a microcomputer system in the future. Do you have information on interfacing it? It should make a good low-cost, high-quality printer. All functions are under logic level control so it should be easier to connect than a Selectric. Please let me know where I might find such information.

Marlo R. Martin
Berkeley Scientific
Translation Service
PO Box 4248
Berkeley CA 94704

I'm in the market for a small-business computer. I produce a bimonthly photo-marketing newsletter that pairs picture buyers and photographers. I know little about computers and even less about how to find just what I need from an "unbiased" computer salesman. Here's my dilemma; maybe your readers can enlighten me.

(continued on page 131)

NOW... Exclusively Yours from ACS

TRS-80®-DOS 3.0

Disc Operating System by the Original Author

☐ DOS 3.0

SPECIAL RELEASE PRICE

ONLY $39.95

Check these DOS 3.0 features . . . that go far beyond 2.1

NO KEY BOUNCE • NEW COMMANDS • CHECK EOF • WRITE EOF
SEEK • RE-READ • RE-WRITE • LOC • VARABLE LENGTH RECORDS
SKIP • DISK LOGGING OF MESSAGES • BOOT • CHAIN • PAUSE
PURGE • SET • RESET • ROUTE • RUN & LOAD FOR 1 DRIVE SYS.
XFER • FORMAT W/O ERASE • DIR FROM BASIC • PATCH • LINK
USER DEFINED KEYS • KEY AUTO REPEAT • UPPER AND LOWER
CASE DRIVER • SHIFT LOCK • RS-232-C DRIVERS
MULTI PROTOCOL COMMUNICATIONS

HARDWARE FOR TRS-80®

☐ **Pertec Disc Drives FD-200 ..... $375.00 ea.**
These are 40-track Drives that are completely compatable with the TRS-80® and Radio Shack Drives. 3.0 DOS included. Will allow Turning Diskette over and Write on other side.

☐ **16K Upgrade Kit ..... $ 99.95**

☐ **779 Centronics TRACTOR FEED Printer $1100.00**
Same as Radio Shacks Complete with Cable. Shipped Freight COD.

☐ **701 Centronics TRACTOR FEED Bidirectional Printer $1549.95**
2½ times as fast as the Radio Shack 779 Printer, has full size 132 Char. Carriage Bell tone. Complete with Cable plug in and use. Shipped Freight COD.

☐ **200 ns 16K Dynamic Memory Clips for Keyboard or Expansion Interface, Lifetime Guarantee, complete ... $110.00**
Lifetime Guarantee. Complete with Instructions and Jumper Blocks.

☐ **TRS-80®-Level II – 4k $540.00**

☐ **TRS-80®-Level II – 16k w/10 Key Keypad $900.00**

☐ **Expansion Interface $275.00**

☐ **RS-232-C Interface ..... $ 89.00**

ORDER NOW AND SAVE

Just list the items you want and mail this convenient coupon.

SOFTWARE BY ACS

☐ **Monitor No. 3 ..... $ 39.95**
Complete Machine Language Monitor for TRS-80® features: Find, EDIT, Relocate, Symbolic Dump to Tape, etc.

☐ **Trash DATA BASE Management System ..... $ 89.95**
A complete all around DBMS for business or home. Information can be stored in any fashion. Comes on Disk with Documentation.

☐ **PLCEND ..... $ 15.95**
Will Patch ASCII files of Basic Programs or text or DATA FILES so that they may be loaded into the Disk Version of the Electric Pencil for Editing purposes comes on Cassette that will automatically create a Disk file of PCLEND.

☐ **MAKE TAPE AND MAKE DISK for Cassette Dealers ..... $ 69.95**
These are two programs that will allow you to take any type of Program from Disk and store it on tape for mailing purposes. When the user receives the program in the mail on cassette, it is loaded into the computer which will automatically make a Disk file of the program.

☐ **CP/M & C BASIC for the TRS-80®**
CP/M Includes: MOVCPM, STAT, PIP, Dump, DDT, ASM (8080), ED, plus 6 user manuals.
CP/M $150.00
C Basic-2 Includes: XREF2, CBAS2, and manuals.
C BASIC 2 ..... $ 99.95

☐ **G2 LEVEL III BASIC for TRS-80® ..... Special $39.95**

☐ **TELCOM – Telecommunications for the TRS-80®.. $ 29.95**
Telecommunications for the TRS-80® allows one TRS-80® to communicate with another through the RS-232-C over the phone line.

® TRS-80 is a registered trademark of Radio Shack, a division of Tandy Corp.

VISA* master charge

Orders received by 6:00 p.m. shipped next day on Master Charge, Visa, Certified Check or Money Order. Personal Checks require 14 days to clear. No C.O.D. Collect calls not accepted. All Hardware warranted for 90 days except Radio Shaok equipment which is warranted through Radio Shack. All Software is sold "AS IS" with no guarantee. Prices subject to change without notice.

AUTOMATED COMPUTER SOFTWARE SERVICE

(615) 244-2798

Division of Computer World INC.

625 Main Street • Nashville, TN 37206

✓A75

Send Check or Money Order payable to –

SOFTWARE • P.O. Box 60097 • Nashville, TN 37206

Quan.	Description	Unit Price	Total

HANDLING CHARGE $1.50
TENN. RES. ADD 6% SALES TAX **TOTAL**

☐ Check
☐ Money Order
☐ MasterCharge
☐ Visa
Card No. _____
Exp. Date _____

Name _____

Address _____

City _____ State _____ Zip _____

NEW PRODUCTS

Edited by Dennis Brisson

Centronics Miniprinter

The Model 730 miniprinter from Centronics Data Computer Corp., Hudson NH 03051, offers a first-of-its-kind three-in-one paper-handling system and uses the same heavy-duty free-flight print head technology found in all Centronics 700 series printers. The 730 features 50 cps print speed, 80-column line length at 10 characters per inch, full uppercase and lowercase 96-character ASCII set, high-quality 7 × 7 dot-matrix printing, a full line buffer and high-speed carriage return.

The 730's built-in ability to handle not only fanfold or roll paper, but also cut sheets means that now, from just one output device, a user can perform a more diverse set of functions. The long-lasting ribbon system features a Mobius loop, which allows printing on upper and lower portions on alternate passes. Smaller and lighter than the average-size portable typewriter, these dot-matrix printer units weigh less than 10 pounds and measure 14.5 × 11 × 4.89 inches.

The Model 730 is part of a seven-member grouping of miniprinters—Models 730-1 through 730-7. Two models are designed for North America; four will satisfy European demands; while the seventh unit, with a Katakana character set, will be made available in Japan. Prices start as low as $995. Reader Service number C136.

The Model 730.

Percom Software

Development and debugging software for 6800 microcomputer programming has recently been added to the software line of Percom Data Company, 211 N. Kirby, Garland TX 75042. The six programs—an assembler-linking loader, three disassemblers, a relocator and a monitor with debugging conveniences—were developed by Ed Smith's Software Works company and are available on either cassette or disk—except Monitor, which is in EPROM. Cassettes are Kansas City Standard format at 300 baud.

The programs, which work with Percom operating systems, are: Relocating Assembler and Linking Loader (tape, $50; disk, $55.95), Relocating Disassembler and Segmented Source Text Generator (tape, $35; disk, $40.95), Disassembler/Source Generator (tape, $25; disk, $30.95), Disassembler/Trace (tape, $20; disk, $25.95), Relocator (tape, $20; disk, $25.95) and Monitor (on a 2716, $70). Texas residents must add 5 percent sales tax. Reader Service number P7.

IMP System.

Accounting and Word-Processing System

The IMP System is a fully integrated accounting and word-processing system. Its word-processing program can extract from the accounting files alphanumeric data on customers, suppliers, salesmen, sales, payments, commissions, purchases, inventory, etc., and insert the data at any point in a letter. At the rate of one page per minute, users of the IMP System can thus produce in volume correspondence that is personalized, accurate and up to date.

The IMP System, including both hardware and software for both accounting and word processing, is available for about $400 per month (on a 5-year lease).

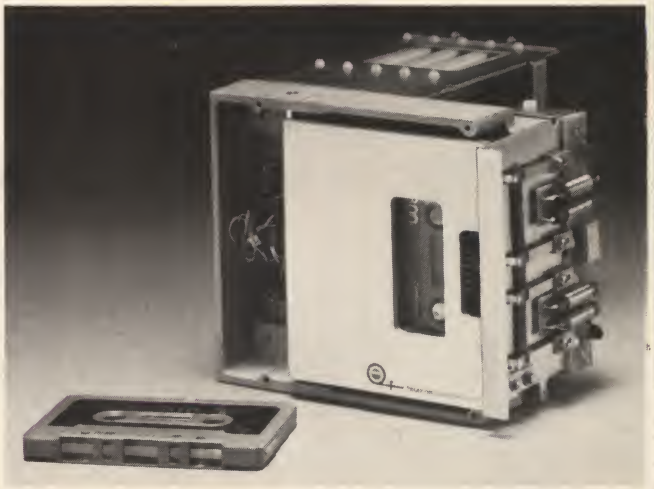
Infotecs, Inc., One Perimeter Road, Manchester NH 03103. Reader Service number 140.

Cassette Tape Transport

The SEI Model 4240 four-track Digital Cassette Tape Transport is the industry's first high-speed 1600 bpi cassette tape transport. The 4240's four-track capability provides storage capacity comparable to that of 3M data cartridges at less cost and inconvenience to the end user.

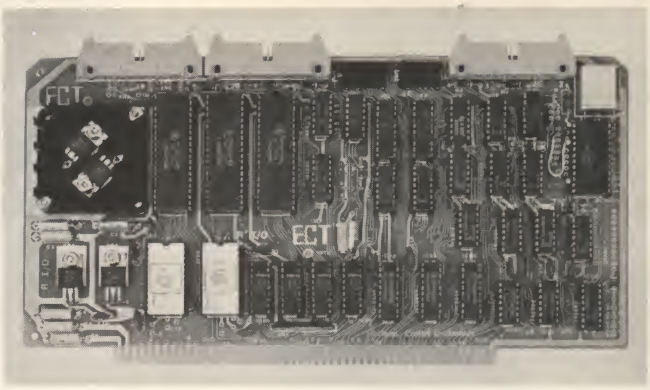
Model 4240 design features include 30 ips read/write and 60 ips search speeds for fast data entry or retrieval, ceramic edge-referenced tape guidance to within .001 for proper data integrity, elimination of pinch rollers and capstan for greater reliability. Compact modular construction fits most systems.

Saylor Electronics International, Inc., 1436 E. Katella Ave., Anaheim CA 92805. Reader Service number S99.



Model 4240.

The DPS-1.



R²I/O board.

DPS-1

The DPS-1 is a versatile computer tool with the designed-in flexibility of the new IEEE specification bus architecture, the industry's most widely used microcomputer bus. With a choice of over 500 peripherals and components, you can easily apply the DPS-1 to virtually any computing task: scientific computing, data, distributed or real-time processing. The DPS-1 can support modules manufactured by over 60 vendors. This allows a wide selection of compatible peripherals, including such special-purpose products as speech synthesizers, vocoders and even associative memory.

In addition to the Examine, Examine Next, Deposit, Deposit Next and Single Step functions, the front panel includes a Slow Step function so you can watch a program execute at any speed from .1 to 1000 instructions per second. You can couple this with the hardware breakpoint and your lab oscilloscope to create a logic analyzer. The front panel can handle any 8-bit processor: 8080, 8085, Z-80, and even 6800 and 6502.

Twenty motherboard card slots permit nondisruptive expansion of your computing capabilities from just a few cards to a full-blown customized system. Fully shielded and terminated, the bus includes low-impedance grounds between each line and active signal termination to virtually eliminate crosstalk, reflection and other bus noise.

InterSystems, PO Box 91, Ithaca NY 14850. Reader Service number 141.

Business Software

Graham-Dorian Software Systems, 211 N. Broadway, Wichita KS 67202, has added four programs—Accounts Receivable, Accounts Payable, General Ledger and Job Costing—to their line of computer software for business and industry. The new programs tie together, so the user can start with one and add others as desired.

Their on-line capabilities enable an operator to make a single entry and update all affected files. An inquiry into a file at any time provides up-to-date information with no batching or sorting of input data. Messages on the video display guide the operator each step of the way. An invalid operator request or invalid data entry produces an error message immediately. The new packages are compatible with 8080, 8085 and Z-80-based systems. Reader Service number G20.

Programs from Graham-Dorian.

ROM, RAM and I/O Board

R²I/O is an S-100 bus I/O board with three serial I/O ports, one parallel I/O port, four status ports, 2K of ROM and 2K of RAM. The R²I/O provides a convenient means of interfacing several I/O devices, such as CRT terminals, line printers, modems or other devices, to an S-100 bus microcomputer or dedicated controller.

It also provides for convenient microcomputer system control from a terminal keyboard with a ROM monitor containing executive commands and I/O routines. Or, it can be used in dedicated control applications to produce a system with a minimum number of boards, since it contains ROM, RAM and I/O. Baud rates are individually selectable from 75-9600, and the voltage levels of the serial I/O ports are RS-232. Low-profile sockets are provided for all integrated circuits. Price is $295.

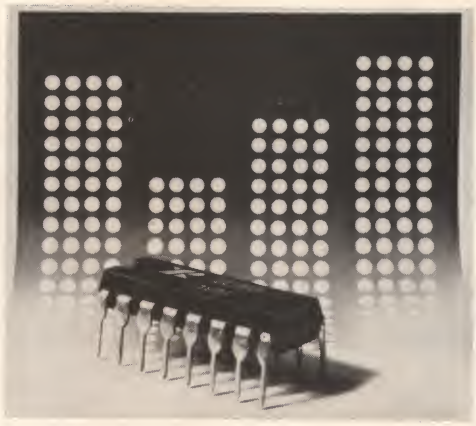
Electronic Control Technology, 763 Ramsey Ave., Hillside NJ 07205. Reader Service number E47.

TRS-80 Light Pen

A self-contained light pen that plugs directly into the Radio Shack TRS-80 bus connector now makes it possible to bypass the TRS-80's keyboard and interact directly with the information displayed on the CRT screen. The light pen adds versatility to most graphics programs and makes possible unique games. Applications include selection from a

TRS-80 light pen in use.

The Trendcom 100.



The XR-2276.

menu displayed on the screen by using the light pen and educational games or teaching aids that allow the student to interact directly with the display on the screen.

The light pen is completely assembled and ready to plug into the TRS-80. A sample program and programming instructions are included with the pen. Price is $34.95 (plus $1.50 for postage and handling within the United States; $6 for foreign orders).

3G Company, Inc., Rt. 3, Box 28a, Gaston OR 97119. Reader Service number T65.

OSI Accounting System

The OS-AMCAP is a disk-based small-business accounting system that provides a full accounting bookkeeping system where larger systems are uneconomical. This turnkey business system is furnished on three 8 inch floppy disks, and may be used on any Ohio Scientific 6502-based system with 48K of RAM and at least a dual-floppy capability.

OS-AMCAP features variable allocation capability, which allows the business user to select the amount of memory space to be reserved for the various working files (Accounts Receivable, Accounts Payable, Inventory and Payroll), limited only by disk storage availability. It also provides a comprehensive General Ledger package and a Billing/Invoicing module. The Billing/Invoicing system will support an imbedded Customer Files program, if desired. The General Ledger module will provide a complete chart of accounts, Cash Receipts/Disbursements and account-balancing features. All modules are fully interactive through a common data-base and provide easy-to-read reports. Price is $975.

Ohio Scientific, 1333 Chillicothe Rd., Aurora OH 44202. Reader Service number O1.

Intelligent Printer

The Trendcom 100 Intelligent Printer provides the microcomputer user with 40-column hard copy on 4½ inch wide paper. Interfaces are available for TRS-80, Apple II, PET and Sorcerer.

The Trendcom 100 features bidirectional 40 cps printing with a full 96-character ASCII set, including uppercase and lowercase letters, numerals and punctuation marks. The 5×7 dot-matrix characters are printed with either black or blue images, depending upon the paper used. The microprocessor-controlled unit is exceptionally quiet, since it uses no print hammers, gears or drive belts.

This new printer uses a thick film thermal print head to eliminate the wear and reliability problems that have plagued earlier thermal printers. Projected head life is at least 100,000,000 characters. The Trendcom 100 is fully enclosed in a metal and high-impact plastic case and is available in both 115 V ac and 230 V ac versions. Price is $375.

Trendcom, 484 Oakmead Parkway, Sunnyvale CA 94086. Reader Service number T66.

Memory Emulator Card

The DBM-1 memory card allows any S-100 type computer to be used as a memory emulator during program development for small, dedicated systems. It is a 2K byte memory card that can be accessed by both a development computer and an application computer. The development computer loads the memory with the applications program, which can then be executed by the target computer. It can be used as normal system memory when it is not being used for development.

The DBM-1 interfaces to the application computer via one or two EPROM sockets. The memory interface for the target computer is designed to look like any one of four types of EPROM: 2708, 2758, 2716 and TMS 2716. There are sockets along the top of the board, and EPROM type is selected by which socket is used. A 24-line cable connects the socket(s) on the DBM-1 to the EPROM socket(s) on the target processor.

Two DBM-1s can be cascaded for applications requiring up to 4K of program memory. In these applications the breakpoint logic is daisy chained, allowing the breakpoint to be set for any address in the 4K block. DBM-1 plugs into the S-100 bus. The memories have an access time of 300 ns, allowing full-speed memory emulation with most microcomputers. Prices for DBM-1 are $190, kit; $270, assembled and tested.

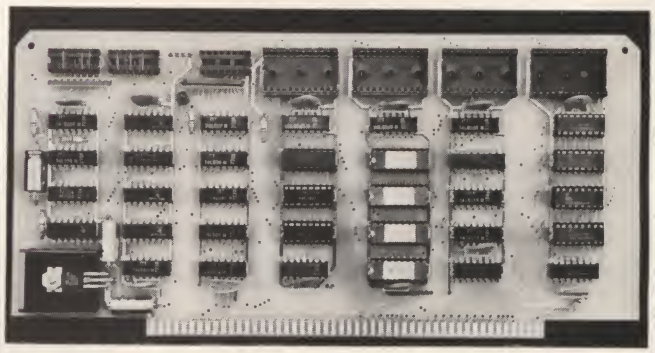
Pragmatic Designs, Inc., 711 Stierlin Road, Mountain View CA 94043. Reader Service number P46.

Bar-Graph Generator IC

The XR-2276, a bar-graph generator integrated circuit to interface with fluorescent or LED displays, is a 12-point level detector designed for use as an "audio-level" indicator in high-fidelity or stereo audio equipment.

The XR-2276 bar-graph generator contains an input buffer amplifier, 12 high-gain comparators with independent buffered outputs, an internal voltage reference and a bias-setting resistor string. Each comparator stage has a threshold level higher than that of the preceding stage. With no input signal, therefore, all comparators are "off" and all outputs at a "low" state. As input level increases, the outputs at 12 discrete input levels successively switch to their "high" states. These threshold levels are set within the range of −20 dB to +8 dB, with reference to an externally adjustable 0 dB level setting. Specifically designed for audio-level detection and display applications, the bar-graph display breakpoints have high sensitivity around the 0 dB level setting, with logarithmically decreasing sensitivity at high and low input levels. The XR-2276 features internal pull-down resistors, logarithmic display characteristics and external reference level adjustment and can function as a 12-point sequential controller, level detector or channel-separation indicator. The circuit offers a wide range of applications in dot-matrix or alphanumeric displays. Price is $2 each in quantities of 100 or more in the 16-pin dual-in-line plastic package.

Exar, 750 Palomar Ave., Sunnyvale CA 94088. Reader Service number E46.



The DBM-1.

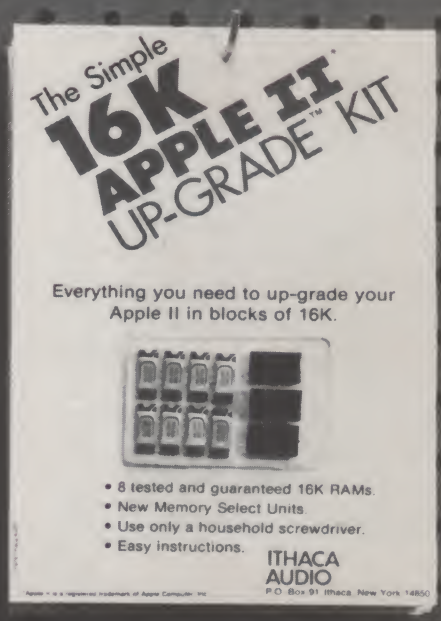
The Simple Up-Grade™

Trying to add computer memory is not much fun if you don't get everything you need.

Receiving unprogrammed jumpers and having to program them yourself is not much better. Most important, that's the place where the problems are introduced.

So Ithaca Audio's better idea is the Simple Up-Grade. Each Simple Up-Grade is specially designed to make adding memory foolproof. We include all the parts you'll need; 8 prime, tested 16K RAMs, along with concise step by step directions and diagrams. And if a personality jumper is required, *it's premade.*

The TRS-80* memory expansion was our first Simple Up-Grade. Now there are two more—for owners of Apple II† and Exidy Sorcerer‡ computers. Each kit is 100% guaranteed—if a part ever fails, we replace it FREE. Your Ithaca Audio dealer has them in stock, only ~~$140~~. Now you can afford to add high quality, high density memory to your system for remarkably little—far less than you would expect to pay from Radio Shack, Apple, or Exidy directly.



These Simple Up-Grades are Ithaca Audio's first step in adding more capability and reliability to your computer at lower cost. Other Up-Grades are on the way to your dealer now.

ITHACA AUDIO

P.O. Box 91
Ithaca, New York 14850
Phone: 607/257-0190

As of June 1st $119.00

*TRS-80 is a registered trademark of Tandy Corp.
†Apple II is a registered trademark of Apple Computer, Inc.
‡Sorcerer is a registered trademark of Exidy, Inc.

LETTERS

Article Update

As soon as my article, "A TRS-80/Selectric Word Processor," was published in the June 1979 issue of *Microcomputing*, I received much correspondence, both by phone and by mail. As a result of comments by readers, I felt obliged to make a couple of additional comments, one of which apologetically compensates for some neglect on my part.

1. In estimating the cost of putting together a TRS-80 word processor, I stated the price of a 16K, Level II TRS-80 as $988. Obviously this cost estimate neglects the cost of an expansion interface. To answer some of my readers' questions: Yes, the expansion interface (or an acceptable substitute as marketed by some independent vendors) is required for the AJ-841 Selectric-based printer, just as the expansion interface is required for any line printer used with the TRS-80. My apologies for not being clear on this, and also for neglecting to include the cost of the expansion interface in my cost estimate of the total system.

2. Some readers inform me that local Radio Shack dealers refuse to accept a TRS-80 for maintenance if *any* kind of hardware mod is installed, even if the mod is nothing more than a simple installation of memory chips by the owner. I checked at my local store and the manager advised me that there is no official policy forbidding RS maintenance on a modified TRS-80, but in some cases the home-brew mods may be so extensive as to preclude maintenance by Radio Shack technicians. I can only advise the reader to check with his local Radio Shack store to get a clear reading on local maintenance policy before installing an upper/lowercase hardware mod.

Although it may not have occurred to some of you, let me remind you that independent firms are springing up to perform general maintenance on microcomputers, just like independent TV repair shops. We have a fine group here in Sacramento CA (PCE Electronics at 4782 Dewey Dr.), which does all kinds of things for the TRS-80: installs Level II modules, numeric keypads and upper/lowercase mods, and performs general maintenance at competitive prices. Also, I have seen some ads where firms advertise TRS-80 repairs at a flat rate plus parts. Check around in your area for similar dealerships.

Along these same lines, if enough of you demand an upper/lowercase capability for your TRS-80—and there certainly seems to be plenty of demand—let Tandy know. Maybe they will respond with a factory-installed kit as they did with the numeric keypad.

3. The upper/lowercase mod as described in the Electric Pencil documentation does not, in its standard form, support upper/lowercase in BASIC. However, I have recently completed the machine-language software that makes the Pencil hardware upper/lowercase mod compatible with BASIC. This software works with the Pencil mod with no changes whatsoever, and the keyboard and printer work correctly. Lowercase is obtained in routine typing without shift, uppercase is obtained with shift, and the printer prints what you type in, in uppercase and lowercase. I will provide a fully documented cassette recording of the software for $8. The program can be used with disk. State 16K, 32K or 48K.

To all of you who responded so kindly to my article, thank you.

Allan J. Domuret
7825 Willowcrest Way
Fair Oaks CA 95628

"Depreciation Analysis" Mods

Joe Ligori's article and program, "Depreciation Analysis" (*Microcomputing*, April 1979, p. 82), was most appropriate for those of us preparing our annual dues to the IRS. However, since my own particular depreciation schedules were based on the 125 percent and 150 percent declining balance methods, I took Mr. Ligori's advice and modified the program to fit my needs. The following minor changes to the program provide the user with a method of controlling the percentage of depreciation. My thanks to Mr. Ligori and *Microcomputing* for the original program.

```
100 PRINT "DECLINING BAL METHOD
DESIRED (1.25, 1.50, 2.00):";:INPUT Z
210 P=(C-S)/Y
212 P=P/(C-S)*Z
Line 266, Delete "DBL"
```

James P. Morgan
Scott AFB IL

Publisher Also Produces Software

Perhaps Peter Stark ("Who Sells Software?" April 1979 issue, p. 48) inadvertently left Hayden off his list. There may be readers of *Microcomputing* who haven't heard that Hayden produces software for the Apple II, KIM-1, PET and TRS-80 machines. Please let them know.

S. William Cook, Jr.
Editorial Director
Hayden Book Co.
Rochelle Park NJ

Computers Go to School

In response to Wayne's editorial of April 1979 categorizing computer types: Have you overlooked the school market in microcomputers, or is the market now large enough to support another magazine, *Educational Computers*? I think that school systems will by far constitute the largest market for microcomputers, peripherals, instructional and game software.

In our rural, small-town school system of 13 schools, we now count 27 PET computers. School boards have indicated they will purchase at least 18 more for the coming school year. The goal announced is for each school to have a classroom full (i.e., 15-25) of computers for each school in the 4-4-3 systems. The rationale is that it takes a roomful of typewriters to teach typing—a computer involves the same kind of practice. That goal is a part of a five-year plan. This would mean a total of 780 computers by 1985, or nearly a doubling of the number each year for the next five years.

As you have indicated, the software requirement is fabulous. We just ordered ten copies of the PET Tutor tapes for use in July.

In the next year we will offer the following basic courses on the PET: (1) a course in computer survival for kids (July 1979); (2) a survival course in computer programming for teachers (September 1979); (3) a course in PILOT for elementary-school teachers (April 1980). All 17 schools in the area, including parochial schools, will have courses in BASIC programming next year.

I think this level of activity may be duplicated in many schools across the country and will reach thousands in a short period.

Everett Q. Carr, Director
Herkimer BOCES Planetarium
E. Herkimer NY

In addition to encouraging as much programming for educational computers as possible via Instant Software, we are also seriously working on starting an educational microcomputing magazine. This means we need staffers: editors, proofreaders, technical editor, some writers, advertising sales, bookkeepers, clerical and production workers. We want to put out a magazine that will help educators know what is available in both hardware and software, and what systems have worked well in school environments. Articles along this line will be accepted for publication in Microcomputing *until the new magazine is ready to go—Wayne.*

EPROMblems

Dr. McFarland's "El Cheapo" EPROM Programmer (March 1979, p. 46) will cause problems when used in an 8080- or Z-80-based system. The $\overline{CS}$ decoding scheme will enable a ROM when an I/O operation involving parts 128_{10} to 159_{10} is performed. If it is an input operation, both the I/O board and the ROM will attempt to put data on the data-input bus. Since most I/O boards use TTL buffers, the MOS ROM could be damaged.

A simple fix is to use a NAND gate (74LS00) and run MEMR-H and an active-high address to its inputs. The NAND gate's output goes to E1 or E2 of the 8205.

Since I do not intend to program more than one ROM at a time, and I have ROM sockets elsewhere, I have replaced the 8205 with a 74LS30 (8-input NAND). The six address lines and MEMR-H must be high in order to get a $\overline{CS}$.

Bernard Jon Siegel
Jacksonville FL

Regarding Mr. Siegel's letter about modifications to my EPROM programmer: Since the prototype was designed for a 6502-based system, I am accus-

tomed to memory-mapped I/O. Reviewing the data sheet for the 8080, I think he is correct that some means of gating out the ROM(s) in the chip decoding scheme is essential. Although I have not tried them, the methods he suggests seem appropriate. This will affect anyone attempting to use the programmer with an 8080 or Z-80 system.

Ward J. McFarland, Jr., M.D.
New Haven CT

Tornado Aftermath

In the recent tornado that wreaked unholy havoc on our city, many of us in the Wichita Valley TRS-80 Users Group lost our computers, our tape and disk library of software, and our library of computer books and periodicals. Even our club's own library of software and publications was destroyed.

We all have plans to replace our personal computers and software, but at this time I am particularly interested in trying to help our club replace its loss.

Any club, publisher, software producer or individual who wants to do so may contribute non-cash items, such as software, back issues of computer publications and books on computers.

Thank you.

J. Wesley B. Taylor
Secretary, Wichita Valley
TRS-80 Users Group
PO Box 4391
Wichita Falls TX 76308

Sorcerer Group Seeks New Members

The newly formed Sorcerer User's Group is seeking to expand its membership. Our newsletter, "The Sorcerer's Apprentice," contains useful programs and informative material that Sorcerer owners should find interesting. Free copies of the "Apprentice" can be obtained by sending an SASE to Sorcerer User's Group, 1530 Washtenaw, Ann Arbor MI 48104.

Dave Bristor
Ann Arbor MI

Transfers, Please

I want to congratulate you on your excellent magazine. I have all issues so far and intend to keep my subscription renewed. I also read *Byte, Radio Electronics, Popular Electronics,* etc., but *Microcomputing* is #1.

I would like to comment on something while I'm writing. Please encourage assembly-language programmers to make *all* I/O references via transfer vectors at the beginning of a routine. I know you've had articles about this, but keep on pressing. It's very discouraging to try to adapt software when you do not have listings of firmware or other assumed routines.

Keep up the good work!

Stuart Johnson
Decatur AL

What Might Have Been

In Jeff DeTray's response to a letter from Geary Kelch (Letters, p. 22, May 1979), he states that The Digital Group refused "to adopt a commonly used bus." Since it appears that he is "scolding" The Digital Group for this, I would like to say the following in defense of The Digital Group for their decision.

The Digital Group, by using their own bus, attempted to give personal-computer users a bus that could support any of several microprocessors. The DG made CPU boards for the 8080, Z-80, 6800 and 6502. (Presumably it would not be too hard to make CPU boards for other micros as well.) The only "commonly used" buses in existence at the time of the first DG computer were the S-100 and (possibly) the SS-50. Both of these, especially the S-100, seemed unsuited to supporting more than one or two different types of microprocessors.

If the DG bus had become popular, there would have been at least a chance that DG bus boards could have been used with (just about) any 8-bit microprocessor. This would have allowed users to choose whichever microprocessor they liked best, and have the same large selection of boards available.

I do agree with Mr. DeTray that DG should have made information available that would have allowed other companies to make DG-compatible boards. This seems the only way that DG computers could have become a major factor in personal computing.

Jim Howell
San Jose CA

PUBLISHER'S REMARKS

(from page 5)

much in terms of buying power to making perhaps 50 to 75 percent? I gather that much of this has to do with the printing of extra paper money by our country to pay for our expedition into Viet Nam. Our inflation has been worse than the others. Indeed, one of the problems the Swiss are now having is that they have not printed more paper money than their income, and the result is that much of the world would like to get their paper money since it is holding its value so well. This demand for their money has been forcing the value of the money upwards and making prices in Switzerland even higher than in other European countries.

One notices the difference in little things, such as the profusion of Mercedes Benz cars, which are everywhere. It isn't that they are cheap in Europe, it's just that many Europeans have the money to buy $20,000-and-up cars. The demand is so great that there is a two year backlog of orders for Mercedes.

One notices that all of the gas stations are open on weekends and that there are no lines for gas. One also notices that gas costs about $2.25 a gallon. One thinks a bit about that while driving along the superhighways where there are no speed limits. For instance, I was driving on the autobahn between Stuttgart and Munich, and Sherry had dozed off. She woke up and noticed that I was buzzing right along in our rented BMW car. She asked how fast I was driving and I said we were going about 95 mph. She then asked if anyone was passing me . . . just then a Porsche went by at perhaps 150 mph . . . and I said, yes, occasionally.

When I talked with Peter, the Midwest Scientific dealer in Munich, who has a Porsche and a Mini (the Mini for driving in town), he pointed out that the Porsche is very good because he can make the run to Hamburg, about 470 miles, and cover it in about three hours. At our 55 mile limit it would take him 8½ hours and be impractical for business to drive. I don't know how much gas the Porsche uses at 160 mph, but I'll bet it's less than most big American cars use at slower speeds.

Poll

There was a little reader poll in the June issue of *Microcomputing*, and the first results are in from it. I'll go into more of the gory details in my "Microcomputing Industry Newsletter" ($5 per year for subscription).

We asked readers to let us know what microcomputer system they were using; 31.0 percent were using TRS-80 Level II systems. The next most popular, to my surprise, was the Apple II, with 7.4 percent of the market. Third was the Southwest Tech system with 6.3 percent penetration. Then came the Commodore PET with 5.4 percent.

I had expected the PET to stay in second place, but the almost total lack of advertising of the system, the delays in getting out new models, the delays in peripherals, the scanty supply of software, all have had their impact on this fine system's sales. Apple doesn't seem to have gained much on Tandy, but Commodore has dropped back substantially. It is going to take a lot of advertising to pick up that ball game.

Southwest has been advertising in *Microcomputing*, which I tend to equate with giving a firm a good chance of getting sales, so their strong showing is not very surprising. With some stronger software support I expect them to step up their percentage to at least double the current mark. Southwest is coming on strong in Europe too.

In fifth place was the KIM; however, most KIM owners had more than one system. Next came the Heath H8 with 4.6 percent ownership, a strong showing. This one is coming up fast, too. Once we have some solid software support for the H8, I expect it to come along even faster.

Some Homework Available

The poll showed that the most popular feature in *Microcomputing* is the new-products section. This section handily edged out the Publisher's Remarks, which I suspect are largely a masochistic exercise for most readers. Obviously we need to put more oomph into our new products, making sure that we leave no woodwork unexamined for microcomputer product entrants. You can help.

We need brief (but entertaining and intelligent) reviews of all of the new books being produced. Some are fantastic, some are execrable, and the readers deserve proper notice as to which is which. We'll pay for the reviews, which will at least pay for the book for the first one in with an acceptable report . . . a brief report, I again admonish. If you are too chintzy to buy a book and too honest to steal one, we sometimes can come up with a "loaner" furnished by the publisher.

Even more important are your concise reviews of new equipment which you have purchased and personally evaluated. You don't have to write a ten-page article, just a short piece that gives the salient facts, either warning other gullible computerists against a bummer or providing timid souls with reassurance that all is well . . . perhaps even great. Let's make the new products in *Microcomputing* even more valuable and even less a mere place where manufacturers get a free ad for their stuff.

How to Finance a Computer Store

How would you like to get $50,000 with very little effort on your part? The money is there for the entrepreneur, with absolutely no personal investment required. With that amount of money you could start your own store and be on the way toward success.

All that is required is a bit of sneaky (legal) finkiness. What you do is join a computer club, visit a lot of computer stores or in some way expose yourself to a number of microcomputer users. The next step is to admire the hell out of an Instant Software program they have running, and then convince them to run off a copy for you. Be sure to document this carefully and have a witness.

It may be hard on a computer store or hobbyist or two, but Instant Software is in earnest about the $10,000 reward for the conviction of anyone making a copy of an ISI program. ISI is ready to invest whatever it takes to make an example of a half dozen or so people in order to establish beyond any question the sanctity of computer programs.

ISI would much prefer not to have to resort to tricky codes on programs, which would prevent making copies. There is no objection to anyone making a copy of a program for emergency use . . . or against dumping a cassette program on a disk for faster use. The whole problem is a simple one: If copies of a program are given away, this deprives the programmer of a royalty, and without substantial royalties, we are not going to have the quality of programs that the industry must have to keep growing.

I'm as cheap as any of you, and it bugs the hell out of me to pay full price for anything. Software . . . the only cost there is for the transfer medium, right? If I bring my own cassette, why shouldn't I whip off a quick copy of a few programs? You have to keep cheapskates like me honest unless you want the whole system to get screwed up.

If you are asked by a good friend to run off a copy of a program—you have, at that moment, to make a very important decision. Is that friend really interested in the program or has he one eye on the $10,000 Instant Software is dangling out there? He may be thinking of opening his own store, with you as one of the financiers—in a way.

There are ways to make a program difficult to copy, but do we really want to go that route? It is such a nuisance when you can't run a listing of a program. You may want to make some small modifications in it or perhaps find out why some part of it has bombed without having to write to the manufacturer and wait a couple weeks. If we can keep all of us honest we won't have to be tricky.

Contest!

May's "best article" winners are R. M. Law and D. C. Mitchell, authors of "A Text Formatter in BASIC."

Winner of a book from the Book Nook is James D. Tompkins of Essex Jct. VT.

Lifetime subscription winner can be found on p. 4. Congratulations, all.

APPLE II® PET® TRS·80®

QUALITY SOFTWARE

PROGRAMMA

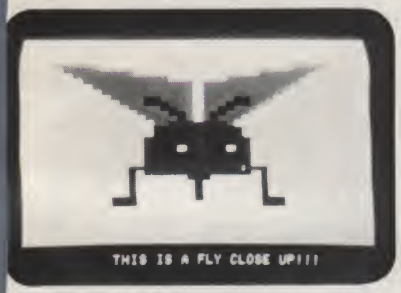
GUNFIGHT $9.95

65Ø2 FORTH
68ØØ FORTH
Z-8Ø FORTH

FORTH is a unique threaded language that is ideally suited for systems and applications programming on a micro-processor system. The user may have the interactive FORTH Compiler/Interpreter system running stand-alone in 4K to 6K bytes of RAM. The system also offers a built-in incremental assembler and text editor. Since the FORTH language is vocabulary based, the user may tailor the system to resemble the needs and structure of any specific application. Programming in FORTH consists of defining new words, which draw upon the existing vocabulary, and which in turn may be used to define even more complex applications. Reverse Polish Notation and LIFO stacks are used in the FORTH system to process arithmetic expressions. Programs written in FORTH are compact and very fast.

APPLE II COMPUTER	$34.95
PET 2001 COMPUTER	$34.95
TRS-80COMPUTER	$34.95

PHAZOR ZAP $15.95



FLYSWATTER $9.95

Apple PIE
TRS-8Ø PIE

PIE (PROGRAMMED IMPROVED EDITOR) is an enhanced curser-based editor that works unlike most currently available text editors. All PIE commands consist of control characters, which are assigned to user defined function locations. The keys of the system input keyboard, are assigned specific PIE Editor function commands by the user. Commands in the PIE Editor may optionally be preceded by an Escape character, followed by a numeric or string argument.

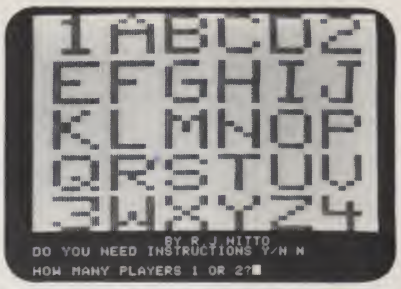
APPLE II COMPUTER	$19.95
TRS-8Ø COMPUTER	$19.95

DEPTH CHARGE $15.95

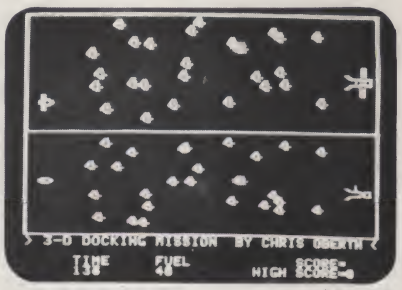
All orders include 3% postage and handling. Apple II is a registered trademark of Apple Computer, Inc. Pet is a registered trademark of Commodore International and TRS-80 is a registered trademark of Radio Shack. California residents add 6% sales tax.
VISA & MASTERCHARGE Accepted.

PIRATES $9.95

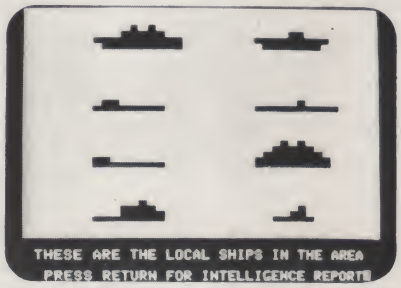
APPLE II LIGHT PEN $34.95



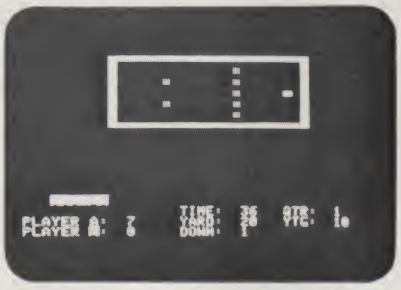
MATCH WITS $9.95



3-D DOCKING $15.95



SUB ATTACK $9.95



FOOTBALL $9.95

PROGRAMMA INTERNATIONAL, Inc.
3400 Wilshire Blvd.
Los Angeles, CA 90010
(213) 384-0579

✓P48

DEALER INQUIRIES INVITED

Software Products

✓ Reader Service—see page 179

Carol Ascolillo
Nancy Schwartz
Morse Circle
Northboro MA 01532

Cover Up

This useful home-decoration software is a superb example of "human engineering." Ingenious programming makes it virtually foolproof. Shouldn't all software be written this way?

Cover Up makes it possible for you to consult with your PET before covering up those areas in your home or office with wallpaper, paint, paneling or carpeting. The following series of programs are designed for two types of users. For those who daydream about redecorating a room but who are not yet ready to act on their impulses, these programs will enable you to sit in the comfort and privacy of your own home while allowing your fancy to take flight.

On the other hand, for those who have reached their time of decision and are ready for action, the information gleaned from these programs will help you to avoid the embarrassment of beating a hasty retreat from the decorating center when faced with the reality of the cost and involvement of the upcoming project.

As an additional bonus, the series will demonstrate unusual programming techniques that utilize the unique capabilities lurking in the PET.

Special Features

Cover Up was developed on the Commodore PET, 8K version. Although the overall program is in excess of 25K bytes, the memory limitation is removed by controlling access to the separate portions by means of the main Content program (see Fig. 1), which includes a high-speed tape search routine.

With each program approaching 6K, it would take an excessive amount of time to search at the usual rate. To overcome the lengthy delay, the search was eliminated by implementing a modified Fast Forward routine. In doing this, we discovered a strange PET phenomenon.

The object was to print a message instructing the user to press the fast forward key on the cassette and have the message remain on the screen until the computer sensed that the key was actually depressed (Cover Up program, lines 160-180). This was done to ensure that the cassette was set in the fast forward mode before the Automatic Advance routine—which advances the tape to the beginning of the particular program selected in the next prompt—was executed. However, the message would only remain on the screen less than five seconds before it would print out the next prompt. Incorporating a seemingly unnecessary FOR-TO loop in line 165 accomplished this.

Furthermore, it became apparent that the routine was not operable under certain conditions. For example, the routine was disabled by the presence anywhere in the program listing of a REM statement. When the fast forward key is depressed, the loop is aborted and the program selection menu is displayed.

Conversely, there were portions that had to be tested for a "No Key Depress." We assumed logically that by changing one of the test lines in the Key Depress routine, we would satisfy the test requirement. It became empirically apparent that the FOR-TO loop must be eliminated in order for the "No Key Depress" to work (Cover Up program, lines 140-155). These routines can be used as standard "Key Depress" routines.

A variation of these routines that waits for an alphanumeric input to start a sequence is also used in the Fast Forward routine when the user selects the program number (Cover Up program, lines 315-330). The cassette is turned on and automatically advanced to the proper place on the tape. The amount of fast forward running time (T) is determined by utilizing the internal clock. (TI) represents the present time in jiffies; (T) represents the amount of

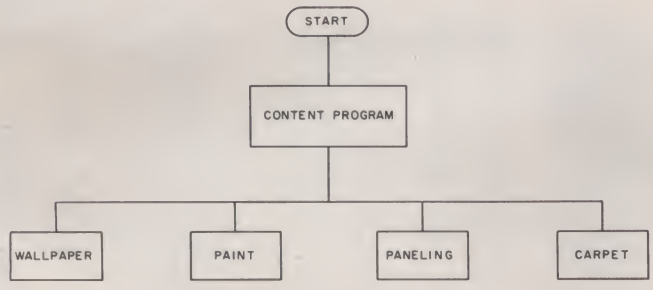


Fig. 1. Generalized flowchart.

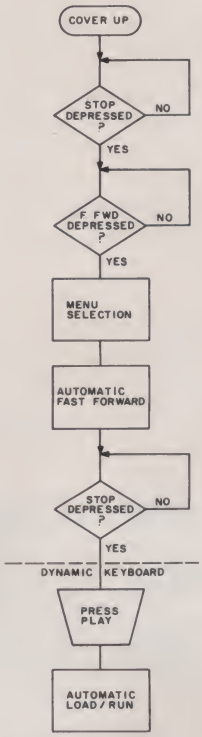


Fig. 2. Cover Up program flowchart.

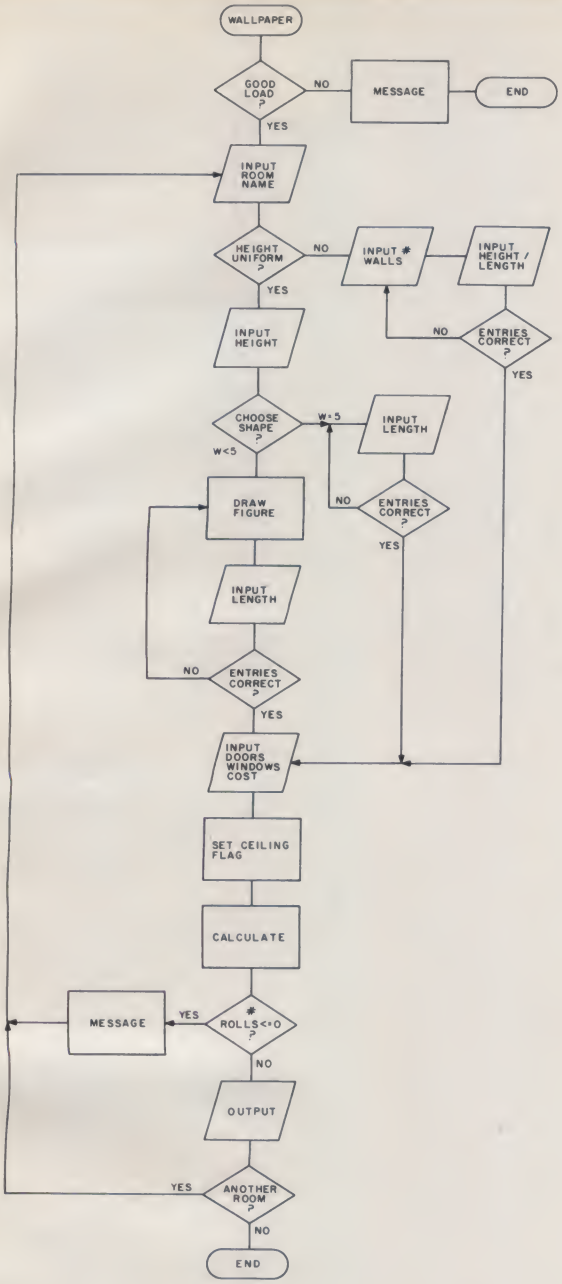


Fig. 3. Wallpaper program flowchart.

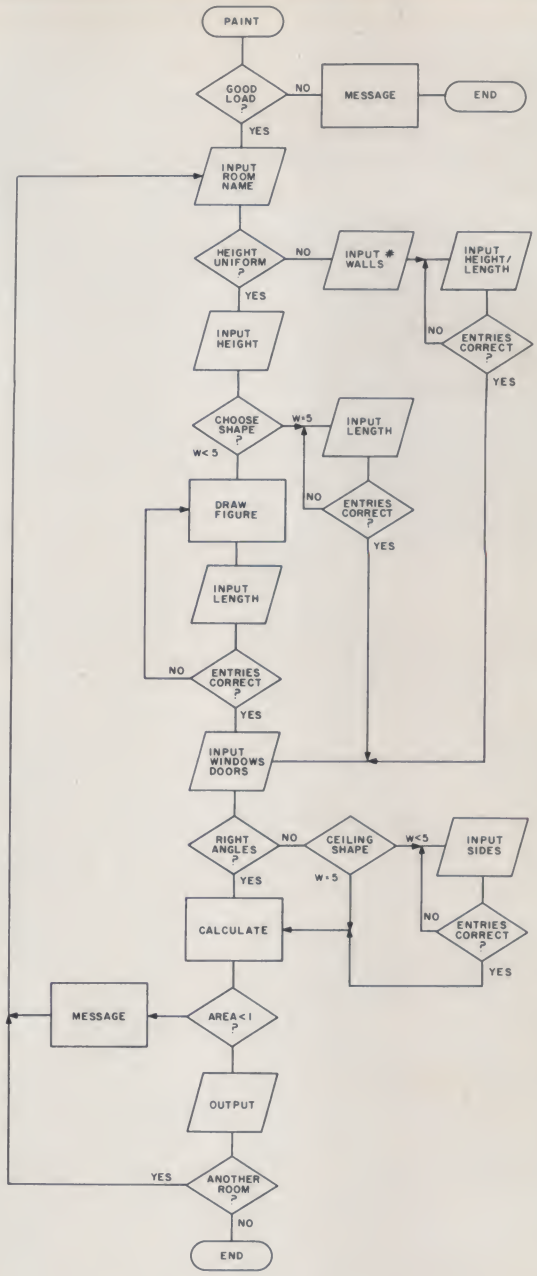


Fig. 4. Paint program flowchart.

time the cassette motor is on. When the equation is satisfied, the cassette automatically shuts off and further instructions are printed.

Once the program is selected and the tape has advanced to the designated tape location, the Content program is still resident but has reached a breakpoint and is not technically operational. At this point, one of the PET's most fascinating oddities is brought into play: a "Dynamic Keyboard" (found in lines 360-375).

When BASIC is running, the computer ignores keyboard inputs except when given explicit INPUT instructions. The PET has set aside memory location 525 as the "keyboard counter" and locations 526-530 as a keyboard buffer. Characters typed on the keyboard, while BASIC is running, are stored in the buffer and the counter is incremented for each character.

When the program ends in BASIC, the computer automatically examines the counter and reads the buffer contents. This can be used as a type-ahead feature, or as in this case, to produce a new command automatically.

By using a series of instructions stored in the buffer, any direct commands that appear on the screen at program's end are interpreted by the computer as command statements. In this instance, this capability was utilized to automatically set the PET in the LOAD mode. The use of CHR$(131) not only initiates loading but causes the newly loaded program to run automatically. Thus, the user need only depress the PLAY key, as instructed, to load and run the program chosen.

The PET checks for loading errors as a program is loaded. However, the PET will only print a LOAD ERROR message for certain values of the stack. In order to provide a complete check, each segment checks for any status error and prints out a message so that the user will be aware of a bad load (Wallpaper program, line 400).

In developing these programs, we have attempted, as far as possible, to compensate for the human factor by anticipating inaccurate input. The

idea behind this human engineering is for the program to absorb the complexity and relieve the user of as much burden as possible, a concept that often separates professional programming from hobbyist work.

We used two types of input statements, the INPUT and GET commands, coupled with appropriate subroutines to check each entry. Normally, inputting a carriage return in response to the basic INPUT command will cause the program to crash. To avoid this, the first type of input statements we used in the program was the OPEN FILE 1,0,1 command (Wallpaper program, line 500). This statement must be placed in the program so that it is executed only one time. The actual data entry command must then read INPUT #1 (Wallpaper program, line 1000). This type of input command will cause the program to wait for a data entry.

The second type of input, the GET command, contains another unique feature of the PET. The GET command is structured so that no carriage return is necessary after a data entry. It is limited to a single character entry. We took advantage of this by implementing this ability for data requiring not more than one character. The subroutine in the Wallpaper program at line 9200 not only checks the validity of the input, but allows the user to respond to these prompts by typing a single entry, without a carriage return to continue on in the program operation.

On entries of indeterminate length, the user must carriage return to flag data completion. This was necessitated by the PET quirk of reading all display on the same line as input, including any graphics to the right of the data input. This was handled by using the GET command and by checking each individual character upon entry for validity (Wallpaper program, subroutine at 9100).

These individual data elements are then concatenated, and the resulting variable is then checked to ensure that it falls within predetermined parameters. The input is checked for commonsense input (for example, what you would expect for the length of a wall).

An entry of a number when a letter is expected, and vice versa, can cause the program to crash, so all data, regardless of nature, is entered as a character string. The character of each entry can then be tested for length—whether it is a delete, a premature carriage return, etc. Numeric values entered as a character are converted by the

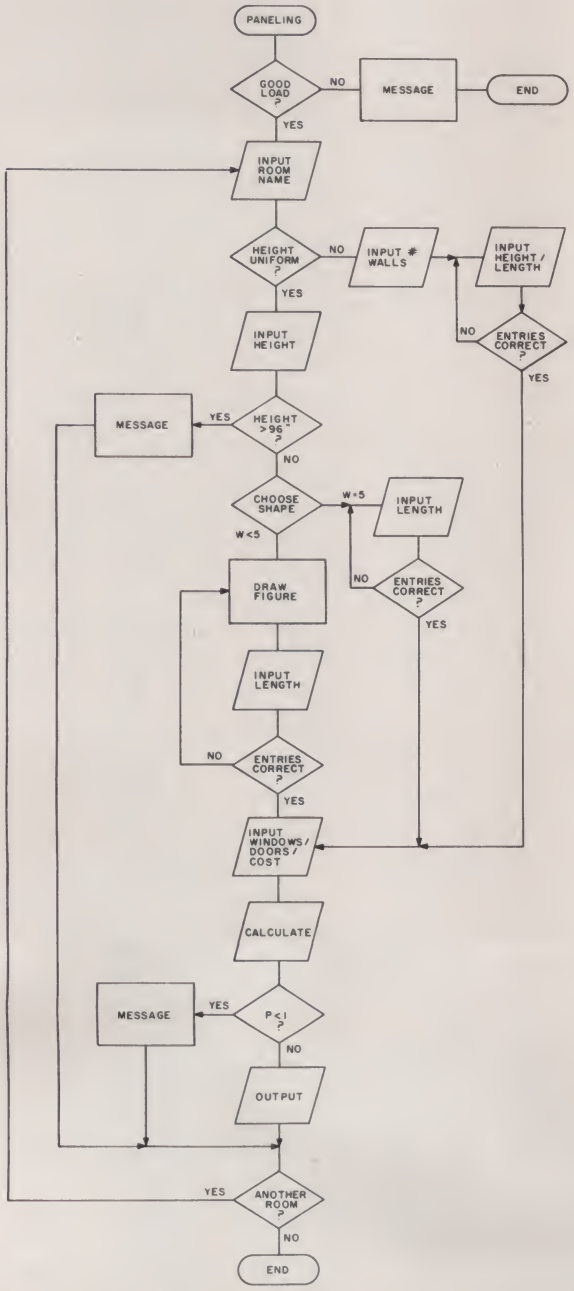


Fig. 5. Paneling program flowchart.

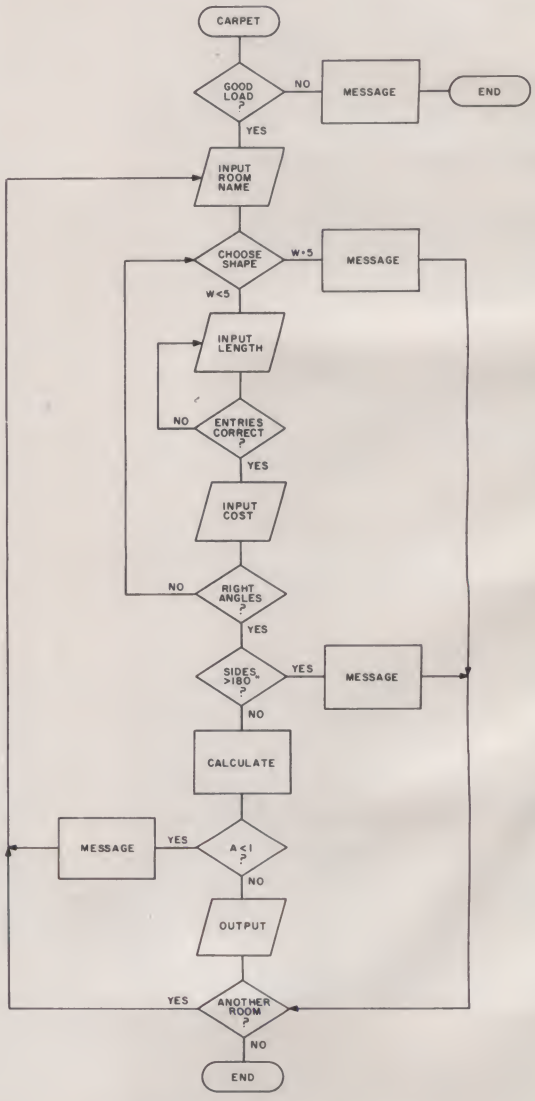


Fig. 6. Carpet program flowchart.

IF YOU OWN A TRS 80*.....

TRS-80 is a product of Radio Shack, A Tandy Corporation

SELECTRA-PRINT PUTS YOU JUST A CABLE LENGTH AWAY FROM A "HARD—COPY" (Typewriter Quality: clean, clear, high-fidelity) Word Processing System!

. . .just a simple hook-up with the supplied cables and your *SELECTRA-PRINT* is ready to run.

For Word Processing on a TRS-80, for example, just command "LPRINT" and *SELECTRA-PRINT* automatically outputs clear, clean, high-fidelity, hard copy. . . . and of course you can use it to print-out any other information you might need.

SPECIAL NOTE:
SELECTRA-PRINT is a Selectric II typewriter and although it has been modified for computer print-out, it may still be used as a standard office typewriter.

PRICE: $1,850.00* *TRS-80 Version $1925.00

OPTIONS:

Dual Pitch	$125.00
Correction Feature	$125.00
Noise Reduction Feature	$50.00
RS-232 Interface	$195.00

Direct International Sales:
International Sales Division
17648 Orna Drive
Granada Hills, CA 91344, USA

Discounts Available to
EDUCATIONAL ACCOUNTS
Contact Delores Sun P.O. Box 8394
Ann Arbor, MI 48105 (313) 665-8514

* *SELECTRA-PRINT is VERSATILE!*
SELECTRA-PRINT is compatible with most micro- and mini-computers including ***PET*** ● ***Apple*** ● ***Heath H8*** ● ***IMSAI*** ● ***Cromemco*** ● ***Alpha Microsystems*** ● ***Space Byte*** ● ***North Star Horizon*** ● ***SWTP*** ● ***Vector Graphic*** ● ***Sol*** ● ***Polymorphic*** ● ***Digital Group*** ● ***Ohio Scientific*** ● ***Altair*** ● ***Sorcerer Xitan*** ● ***Rex*** ● ***KIM*** ● ***EXORcisor*** . . . .

"From now on, **PRINT-OUT takes on a new meaning"**

✓M30

micro computer devices inc.
Dept. K1
960 E. Orangethorpe, Bldg. F
Anaheim, California 92801
Telephone (714) 992-2270

mcd

"Innovators to the Microcomputer Industry"

✓ *Reader Service—see page 179*

A,A1,A2,A3	Variables to calculate ceiling area
A$	Universal "GET:" variable
A	Value (A$) in entry check
A1$	Concatenated "GETS"
A(I)	Value (A1$)
A(J)	Area of individual wall
A,B,C	Calculation variables
B	Total yards for border
B1	Integer (B)
B$	"$"
B$(J)	CHR$ (K)—Poking letters on sides of diagram
C	Total ceiling area and VAL(C$)
C1,C2,C3	Intermediary ceiling calculations
C$	Cost per roll
C1$,C2$	Total cost wall—drop and random match
C3$, C4$	Total cost ceiling—drop and random match
D	Number of doors
D$	"$"
E$	Entries correct (Y or N)
F	Number of windows—Flag for too large dimensions
G,G1,G2	Gallons
G3	Flag—Poking blanks or cursor control for blanks
G4	Flag—Indicate if ceiling calculations have been attempted
G1$	Parameters of acceptable "GET" entries (0-9)
G2$	Flag for Y or N entry
G3$	Final output
H(I)	Height of wall
I,J,K	FOR-TO loop variables
K	ASCII (A,B,C,D,E,F,G,H)—indicate wall
L(J)	Side length of wall
M	Cost
M$	"N/A" or cost
M1$	Concatenated D$ + M$
N	Width of carpet
P	Number of panels
P1	Room perimeter
Q	Quarts
Q3$	Final output
R$	Name of room
T	Total of A(J)s
T1,T1$	Total number drop match rolls
T2,T2$	Total number of random match rolls
T3,T3$	Total number of drop match for ceiling
T4,T4$	Total number of random match for ceiling
U$	Uniform wall height (Y or N)
W	Room shape selection
W1	Number of walls
X	Compensates for doors and windows
X$	"Length" or "$" or Number read from data statement
X3$	"Ceiling" or Null
X9	Determines width of carpet
Y	Tab to compensate for length of cursor movement
Y(K)	ASCII—poking length entry next to wall in figure
Y9	Determines width of carpet
Z	Right angle check (0 or 1) "1" calculates

Variables list.

VAL expression (Wallpaper program, line 9140).

If an entry, for whatever reason, is determined to be invalid, through the use of cursor control and poke statements (Wallpaper program, lines 9250-9290), the invalid input is erased from the screen. This maintains clarity and indicates to the user that the entry must be redone.

After a series of entries has been completed in several portions of the series, the user is asked to indicate if the input is satisfactory. A negative response allows the user to redo that portion without redoing the entire program from the start. Additionally, if, after calculating the output, the program determines that the result is unreasonable, an error message is relayed to the user to check the measurements and begin again.

Additional Features

To enhance user visualization, graphic potential of the PET has been used throughout the program series. The facile implementation of the lowercase mode is demonstrated in the Cover Up program. Line 125 places the keyboard into lowercase mode while line 355 returns it to uppercase graphics mode.

General Operation

After the Content program is loaded, press the STOP key and follow all prompts as they appear. Do not rewind the tape at this time, as it will be set at the proper position for the next program selection. Instructions will be given when the tape should be rewound.

You have a choice of four room configurations in all segments. For those times when only a portion or when an unconventionally shaped room is to be considered, an alternate choice of from one wall or up to nine walls is provided. All measurements are input in inches to maintain consistency throughout. these are then translated into the appropriate measure and calculated accordingly.

To help assure reasonable calculations, the parameters for the wall height and length are set between one inch and 720 inches. In those portions where adjustments are made

500	Title
800	"GET" routine
7000	Checks if configuration warrants calculating
7200	Final calculations
7400	Calculates ceilings and cost when applicable
7500	Prints results of calculations
7800	Error messages
8000	Obtains length value for each wall for figures
8100	Asks number of walls (menu choice #5 or nonuniform wall height)
8300	Checks figure entered for cost per roll
8500	Pokes length figure to appropriate spot on wall
8660	Assigns length to side
9100	Gets and checks length input; converts to ASCII
9190	Pokes spaces if entry is incorrect
9195	Sends to subroutine to move cursor and print spaces
9200	Gets A$ (if LEN(A$) limited to 1 input character)
9250	Pokes spaces
9260	Moves cursor back
9300	Asks if wall height uniform
9370	Moves cursor back; prints spaces, moves cursor back
9400	Asks if entries correct
9500-9530	Sends to subroutines for drawing large figure
9600	Pokes large figures on screen
9800	Draws room shapes for menu selection
9900	Pokes letters on appropriate walls

Main subroutines.

for doors and windows, a maximum entry of nine each is permitted.

Before you attempt a ceiling or carpet calculation, the figures are checked for right-angle compatibility (Wallpaper program, subroutine 7000). If it fails this check, then no calculation is made. N/A will appear on the output when such calculations or costs are not applicable. After each program run, you will be asked if you wish to remain in the current program or if you wish to select another. Instructions will then follow.

Wallpaper

Wallpaper assumes that the standard roll of wallpaper is 36 square yards and deals with both random and drop match types. When using random match paper, there is no need to compensate for a pattern. As a result, calculations are made on the basis of 33 usable square yards per roll. Drop match papers that require a pattern match will render approximately 30 usable square yards per roll.

If you find that you have chosen wallpaper with a drop match of more than 18 inches, we recommend further compensation for waste. An additional caveat: Wallpapers manufactured in foreign countries tend to contain less than the standard 36 square yards found in domestic papers.

The output will show the amount of paper required for the walls and ceiling and the cost of each, if applicable. Ceiling considerations are omitted when the height of the walls is not uniform or if one of the four room configurations is not chosen. Border paper requirements in running yards are also displayed.

Paint

The ceiling calculation will automatically be made if one of the four room configurations is chosen and the walls show right-angle compatibility. If this is not the case, you will be asked to choose one of the four rooms again. At this time, prompts will ask the measurements of the sides of the ceiling.

Paint assumes that coverage of one gallon of paint will be 400 square feet. The output will display the number of square feet to be covered, so that compensation can be made if this coverage differs.

Bearing in mind today's economy, the output will show the amount of paint required to paint the walls and ceiling in quarts and/or gallons.

Paneling

Since the standard sheet of paneling is 4 ft. by 8 ft., Paneling allows for a maximum height input of 96 inches. If a value greater than the maximum allowed is entered, an appropriate message will be displayed. On the other hand, a height entry of 48 inches or less recognizes that the user will be able to get double the length from one panel.

Output includes a ceiling perimeter to help with molding calculations, in addition to the number of panels required and the total cost.

Carpet

One of the four room configurations must be chosen and checked for right-angle compatibility before Carpet will provide an output. The appropriate width of carpet, twelve or fifteen feet, is calculated according to the room dimensions. If the dimensions are unusual and exceed these widths, a message will be displayed to that effect. The calculations are based on the maximum amount of carpeting required to cover the given area. In many cases, however, carpeting can often be pieced to enable coverage with less than the maximum amount.

Output includes the room area in square yards, the carpet width, the amount of carpeting needed in square yards and the total cost.■

Cover Up program.

```
BYTES USED= 1392     PROGRAM 1 - COVER UP          1/17/79

 100 PRINT"cs 8cd";TAB(12);"COPYRIGHT 1978"
 110 PRINT:PRINT:PRINTTAB(10);"BY:CAROL ASCOLILLO"
 120 PRINT:PRINTTAB(18);"&":PRINT:PRINTTAB(13);"NANCY SCHWARTZ"
 125 POKE 59468,14
 130 FOR J=1TO2500:NEXT:GOSUB500:X$=""
 140 PRINT"cs 5cd";TAB(5);"Press 'STOP' key on cassette"
 150 POKE519,52:IF PEEK(519)=52THEN 155
 155 IF PEEK(519)<>0 THEN 150
 160 PRINT"cs 5cd";TAB(5);"Press 'F.FWD' key on cassette"
 165 FORI=1TO1
 170 POKE519,52:IF PEEK(519)=52 THEN 180
 180 IF PEEK(519)=0 THEN 170:NEXT
 200 PRINT"4cd  SELECT PROGRAM BY NUMBER...":PRINT
 210 FOR J=1TO4
 220 READB$,A$
 230 PRINT:PRINTTAB(8);B$;" -";"   ";A$
 240 NEXT J
 245 GOSUB800
 310 IF X=1 THEN 330
 315 POKE59411,53:X=X-1:T=TI+(X*700)
 320 IF TI<T THEN 320
 330 POKE 59411,61
 340 PRINT"cs 11cd 5crPress 'STOP' on cassette"
 345 POKE519,52:IF PEEK(519)=52THEN350
 350 IF PEEK(519)<>0 THEN345
 355 POKE59468,12
 360 PRINT"cs 4cd ch"
 365 POKE525,2:POKE526,131:POKE527,131
 375 END
 400 DATA 1, "WALLPAPER"
 410 DATA 2, "PAINT"
 420 DATA 3, "PANELING"
 430 DATA 4, "CARPET"
 440 GOTO 999
 500 PRINT"cs 4cd"
 510 PRINTTAB(4);"XX      XX     X    X  XXXX   XXX"
 520 PRINTTAB(3);"X  X    X  X   X    X  X      X  X"
 530 PRINTTAB(3);"X      X    X  X    X  XXX    X  X"
 540 PRINTTAB(3);"X      X    X  X    X  X      XXX"
 550 PRINTTAB(3);"X  X    X  X    X X   X      X  X"
 560 PRINTTAB(4);"XX      XX      X     XXXX  X  X"
 570 PRINT:PRINT:PRINT
 580 PRINTTAB(14);"X  X  XXX"
 590 PRINTTAB(14);"X  X  X  X"
 600 PRINTTAB(14);"X  X  X  X"
 610 PRINTTAB(14);"X  X  XXX"
 620 PRINTTAB(14);"X  X  X"
 630 PRINTTAB(15);"XX   X"
 640 FOR J=1TO2500:NEXT
 650 FORJ=32768TO33767:POKEJ,58:NEXT:RETURN
 800 GET X$:IFX$<>""ANDX$<>CHR$(13)THEN820
 810 POKE519,52:POKE59411,61:GOTO0800
 820 X=VAL(LEFT$(X$,1)):IFX<1ORX>4THEN800
 830 RESTORE:RETURN
 999 END
READY.
```

- For graphics at subroutine 9800, use shifted value for symbol shown
- cs = clear screen
  ch = cursor home
  cu = cursor up
  cd = cursor down
  cl = cursor left
  cr = cursor right

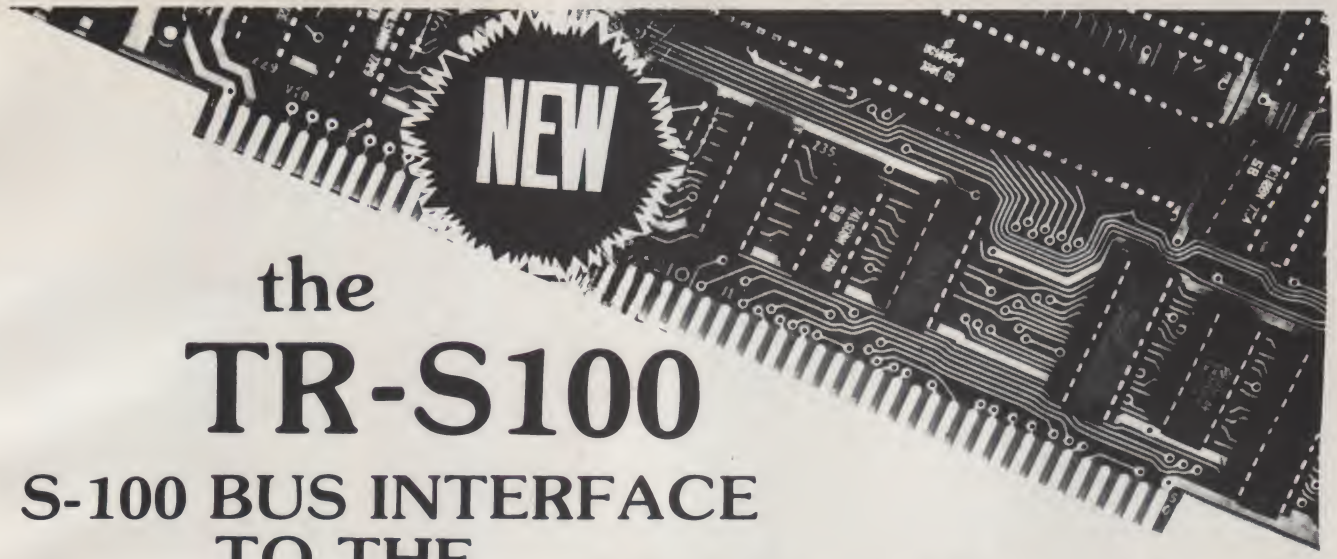
Legend.

Wallpaper program.

```
BYTES USED= 6443     PROGRAM 2 - WALLPAPER     1/17/79

 400 IFST=0THEN500
 410 PRINT"6cd";TAB(4);"PROGRAM DID NOT LOAD PROPERLY"
 420 PRINT:PRINT:PRINTTAB(4);"REWIND TAPE AND LOAD 'COVER UP'":GOTO9999
 500 CLR:OPEN 1,0,1
 550 G3=1:PRINT"cs 3cd";PRINTTAB(5);"*** W A L L P A P E R ***"
 1000 PRINT"4cd";TAB(4);"ENTER NAME OF ROOM: ";:INPUT #1,R$:GOSUB9300
 1020 IF U$="N"THENW=5:GOTO1290
 1100 GOSUB9800:PRINT:PRINT"SELECT SHAPE BY NUMBER: ";
 1110 G1$="1":G2$="5":GOSUB9200:W=VAL(A$)
 1120 IFW=1THENW1=4
 1130 IFW=2THENW1=6
 1140 IFW=3THEN W1=5
 1150 IFW=4THEN W1=8
 1160 IFW=5THEN1290
 1170 GOSUB9360
```

```
1200 PRINT"cs";:ONWGOSUB9500,9510,9520,9530
1230 GOSUB9900:GOSUB8000:GOSUB8660:GOSUB9400:IFE$="N"THEN1200
1285 GOTO1400
1290 G3=2:GOSUB8100:GOSUB9410:IFE$="Y" THEN1400
1300 GOSUB8140:GOSUB9410:IFE$="N"THEN1300
1400 PRINT"cs 6cd";TAB(4);"ENTER NUMBER OF DOORS: ";:G1$="0":G2$="9"
1410 GOSUB9200:D=VAL(A$)
1420 PRINT"2cd";TAB(4);"ENTER NUMBER OF WINDOWS: ";:GOSUB 9200:F=VAL(A$)
1440 PRINT"2cdCOST PER ROLL ('0' IF UNKNOWN): ";:GOSUB8300:C$=A$
2000 GOSUB7000:GOSUB7200:IFVAL(T1$)<=0THENGOSUB7800:GOTO500
2050 GOSUB7500:PRINT"cs 4cdARE YOU PAPERING ANOTHER ROOM (Y OR N)?";:G1$="A"
2060 GOSUB9200:IFA$="Y"THEN500
2070 PRINT"cs 8cd";TAB(2);"TO CONTINUE WITH ANOTHER SELECTION,":PRINT
2080 PRINTTAB(4);"REWIND TAPE AND LOAD 'COVER UP'"
2090 PRINT"4cd";TAB(8);"HAVE A NICE DAY!":PRINT"3cd":GOTO9999
7000 Z=0:ONWGOTO 7020,7030,7040,7060,7025
7020 IFL(1)=L(3)ANDL(2)=L(4)THENZ=1
7025 RETURN
7030 IFL(1)+L(5)=L(3)ANDL(4)+L(6)=L(2)THENZ=1
7035 RETURN
7040 A=L(2)-L(4):B=L(3)-L(1):C=A^2+B^2:C=INT(SQR(C)+.5)
7050 IFL(5)=CORL(5)=C-1ORL(5)=C+1THENZ=1
7055 RETURN
7060 IFL(4)+L(6)+L(8)=L(2)ANDL(3)+L(5)=L(1)+L(7)THENZ=1
7065 RETURN
7200 D=D*20:F=F*10:T=0
7210 FORJ=1TOW1:A(J)=L(J)*H(J)/144:T=T+A(J):NEXT
7220 T1=INT((T-(D+F))/30*10+.5)/10
7230 T2=INT((T-(D+F))/33*10+.5)/10
7240 T1=INT(T1+1):T2=INT(T2+1):T1$=STR$(T1):T2$=STR$(T2)
7250 C=VAL(C$):IFC=0THENC1$="   N/A":C2$=C1$:GOTO7270
7260 X$="$":C1$=STR$(C*T1):C2$=STR$(C*T2):C1$=X$+C1$:C2$=X$+C2$
7270 IFZ=0THENT3$="N/A":T4$=T3$:C3$="   N/A":C4$=C3$:GOTO7350
7280 ONWGOTO7290,7300,7310,7330
7290 A=(L(1)*L(2))/144:GOSUB7400:GOTO7340
7300 A1=L(1)*L(2):A2=L(4)*L(5):A=(A1+A2)/144:GOSUB7400:GOTO7340
7310 A1=L(1)*L(2):A2=L(4)*(L(3)-L(1)):A3=SQR((L(3)-L(1))^2+(L(2)-L(4))^2)
7320 A=(A1+A2+A3)/144:GOSUB7400:GOTO7340
7330 A1=L(1)*L(8):A2=L(6)*(L(1)+L(7)):A3=L(3)*L(4):A=(A1+A2+A3)/144:GOSUB7400
7340 T3$=STR$(T3):T4$=STR$(T4)
7350 B=0:FORJ=1TOW1:B=B+L(J):NEXT:B=B/36:B1=INT(B):IFB1=BTHENRETURN
7360 B=INT(B+1):RETURN
7400 T3=INT(A/30*10+.5)/10:T4=INT(A/33*10+.5)/10:T3=INT(T3+1):T4=INT(T4+1)
7410 IFC=0THENC3$="  N/A":C4$=C3$:RETURN
7420 C3$=STR$(T3*C):C4$=STR$(T4*C):C3$=X$+C3$:C4$=X$+C4$:RETURN
7500 PRINT"cs":PRINTTAB(15-(LEN(R$)/2));"+++ ";R$;" +++":PRINT"2cd"
7510 PRINTTAB(8);"--DROP MATCH--";TAB(25);"-RANDOM MATCH-":PRINT
7520 PRINTTAB(8);"NO.OF";TAB(17);"TOTAL";TAB(25);"NO.OF";TAB(34);"TOTAL"
7530 PRINTTAB(1);"AREA";TAB(8)"ROLLS";TAB(17);"COST";TAB(25);"ROLLS";
7540 PRINTTAB(34);"COST":FORJ=1TO40:PRINT"E";:NEXT:PRINT
7550 PRINT"WALLS";TAB(12-LEN(T1$));T1$;TAB(15);C1$;
7555 PRINTTAB(29-LEN(T2$));T2$;TAB(31);C2$:PRINT
7560 PRINT:PRINT"CEILING";TAB(12-LEN(T3$));T3$;TAB(15);C3$;
7570 PRINTTAB(29-LEN(T4$));T4$;TAB(31);C4$
7580 PRINTTAB(8);:FORJ=1TO16:PRINT"F ";:NEXT:PRINT:PRINT"BORDER";
7590 PRINTTAB(15);B;" RUNNING YARDS"
7600 PRINT:PRINT:PRINTTAB(5);"TO CONTINUE,PRESS ANY KEY";
7610 GETA$:IF A$=""THEN7610
7620 RETURN
7800 PRINT"cs 6cd":PRINTTAB(2);"FIGURES NOT APPLICABLE AS ENTERED"
7810 PRINT"2cd";TAB(2);"PLEASE CHECK MEASUREMENTS AND REDO":PRINT"2cd":GOTO7600
8000 X$="LENGTH":K=65:FORJ=1TO8:B$(J)=CHR$(K):K=K+1:NEXT
8030 PRINT"8cd";TAB(8);X$;"(IN INCHES)"
8040 FORI=1TOW1:PRINT:PRINTTAB(10);"WALL ";B$(I);"= ";
8050 GOSUB9100:A(I)=VAL(A1$):PRINT:PRINT"3cu"
8060 GOSUB 9250:GOSUB 8500:NEXTI:RETURN
8100 PRINT:PRINT:PRINTTAB(4);"ENTER NUMBER OF WALLS: ";
8110 G1$="1":G2$="9":GOSUB 9200:W1=VAL(A$):IFU$="Y"THENGOSUB9360
8140 PRINT"cs":PRINTTAB(3);"WALL";TAB(15);"HEIGHT";TAB(28);"LENGTH"
8150 PRINTTAB(12);"(IN INCHES)";TAB(26);"(IN INCHES)"
8160 FORJ=1TO40:PRINT"$";:NEXT:PRINT:PRINT
8170 FORI=1TOW1:PRINTTAB(3);I;TAB(15);
8180 IFU$="N"THENPRINT"?";:GOSUB9100:H(I)=VAL(A1$):GOTO8200
8190 PRINTH(I);
8200 PRINT:PRINTTAB(28);"cs";"?";:GOSUB9100:L(I)=VAL(A1$):PRINT:PRINT:NEXT
8210 RETURN
8300 INPUT$1,A$:IFA$=CHR$(13)THENPRINT"cu";:GOTO8360
8320 FORJ=1TOLEN(A$):A1$=MID$(A$,J,1):IFA1$="."THEN 8340
8330 IFA1$<CHR$(48)ORA1$>CHR$(57)THEN 8360
8340 NEXTJ:A=VAL(A$):IFA<00RA>99.99THEN8360
8345 IFLEN(A$)>5THEN8360
8350 RETURN
8360 FORK=33280TO33322:POKEK,32:NEXTK:FORK=1TOLEN(A$)+1:PRINT"cl";:NEXTK
8370 GOTO8300
8500 ONIGOTO 8510,8520,8530,8540,8580,8610,8630,8640
8510 M=32863:GOTO 8650
8520 M=33169:GOTO 8650
8530 M=33463:GOTO8650
8540 ON W GOTO8550,8560,8560,8570
8550 M=33204:GOTO 8650
8560 M=33284:GOTO 8650
8570 M=33395:GOTO8650
8580 IFW=2THENM=33117:GOTO8650
8590 IFW=3THENM=33001:GOTO8650
8600 IFW=4THENM=33359:GOTO8650
8610 IFW=2THENM=32995:GOTO8650
8620 IFW=4THENM=33204:GOTO8650
8630 M=33039:GOTO8650
8640 M=32995
8650 FORJ=1TOLEN(A1$):POKEM+J,Y(J):NEXT:RETURN
8660 IF X$="LENGTH"THEN FOR J=1TOW1:L(J)=A(J):NEXT:RETURN
9100 A1$="":K=1
9110 GETA$:IFA$=""THEN9110
9120 IFA$=CHR$(13)THEN9170
9130 IFA$=CHR$(20)THENY=0:ONG3GOSUB9190,9195:GOTO9100
9135 PRINTA$;:IFA$<"0"ORA$>"9"THENY=1:ONG3GOSUB9190,9195:GOTO 9100
9140 A1$=A1$+A$:A9=VAL(A1$)
9150 IFA9<.9OR A9>720THENY=0:ONG3GOSUB9190,9195:GOTO9100
9160 Y(K)=ASC(A$):K=K+1:GOTO9110
9170 IF LEN(A1$)=0THEN9110
9180 RETURN
9190 GOSUB9250:GOSUB9260:RETURN
9195 GOSUB9370:RETURN
9200 GETA$:IFA$=""THEN9200
9205 IFA$=CHR$(13)THEN 9200
9210 IFG1$>"9"THEN 9225
9215 IF A$<G1$ORA$>G2$THEN 9200
9220 GOTO9230
9225 A$=LEFT$(A$,1):IF A$<>"Y"ANDA$<>"N"THEN9200
9230 PRINTA$:RETURN
9250 FORJ=33225TO33235:POKEJ,32:NEXT:RETURN
9260 FORJ=1TOLEN(A1$)+Y:PRINT"cl";:NEXT:RETURN
9280 FORJ=33136TO33152:POKEJ,32:NEXT
9290 FORJ=33218TO33224:POKEJ,32:NEXT:RETURN
9300 PRINT:PRINT:PRINT
9320 PRINTTAB(1);"IS WALL HEIGHT UNIFORM (Y OR N)? ";:G1$="A"
9330 GOSUB9200:U$=A$:IF U$="N" THEN RETURN
9340 PRINT:PRINT:PRINTTAB(4);"ENTER HEIGHT:":PRINTTAB(4);"(IN INCHES)":PRINT
9350 PRINT"3cu";TAB(18);:G3=2:GOSUB9100:G3=1:RETURN
9360 FORJ=1TOW1:H(J)=VAL(A1$):NEXT:RETURN
9370 FORJ=1TOLEN(A1$)+Y:PRINT"cl";:NEXT
9380 FORJ=1TOLEN(A1$)+Y:PRINTCHR$(32);:NEXT
9390 FORJ=1TOLEN(A1$)+Y:PRINT"cl";:NEXT:RETURN
9400 GOSUB9280:PRINT:PRINT"8cd":GOTO9420
9410 PRINT:PRINT:PRINT:X$=""
9420 PRINT"ARE ";X$;" ENTRIES CORRECT (Y OR N)? ";:G1$="A"
9430 GOSUB9200:E$=A$:RETURN
9500 GOSUB9600:GOSUB9610:GOSUB9620:GOSUB9630:RETURN
9510 GOSUB9600:GOSUB9610:GOSUB9640:GOSUB9650:GOSUB9660:GOSUB9670:RETURN
9520 GOSUB9600:GOSUB9610:GOSUB9640:GOSUB9680:GOSUB9670:RETURN
9530 GOSUB9670:GOSUB9600:GOSUB9710:RETURN
9600 FORJ=32934TO33374STEP40:POKEJ,101:NEXT:RETURN
9610 FORJ=33414TO33441:POKEJ,99:NEXT:RETURN
9620 FORJ=33401TO32921STEP-40:POKEJ,103:NEXT:RETURN
9630 FORJ=32894TO32921:POKEJ,100:NEXT:RETURN
9640 FORJ=33402TO33162STEP-40:POKEJ,101:NEXT:RETURN
9650 FORJ=33161TO33153STEP-1:POKEJ,99:NEXT:RETURN
9660 FORJ=33113TO32953STEP-40:POKEJ,101:NEXT:RETURN
9670 FORJ=32894TO32912:POKE J,100:NEXT:RETURN
9680 FORJ=33121TO32945STEP-41:POKEJ,77:NEXT
9700 FOR J=32913TO32916:POKEJ,100:NEXT:RETURN
9710 FORJ=33414TO33432:POKEJ,99:NEXT
9720 FORJ=32952TO33072STEP40:POKEJ,103:NEXT
9725 FORJ=33312TO33392STEP40:POKEJ,103:NEXT
9730 FORJ=33313TO33321:POKEJ,99:NEXT
9740 FORJ=33073TO33081:POKEJ,100:NEXT
9750 FORJ=33122TO33282STEP40:POKEJ,101:NEXT:RETURN
9800 PRINT"cs":PRINTR$;" SHAPE IS....":PRINT
9805 PRINTTAB(5);"$$$$$$$$$$$$$";SPC(5);"$$$$$$$$"
9810 PRINTTAB(2);"1.";SPC(13);"% 2.";SPC(8);"%"
9815 FORJ=1TO2:PRINTTAB(4);"'";SPC(13);"%   '";SPC(8);"%":NEXT
9820 PRINTTAB(4);"'";SPC(13);"%   '";SPC(8);"#####%"
9825 FORJ=1TO2:PRINTTAB(4);"'";SPC(13);"%   '";SPC(13);"%":NEXT
9830 PRINTTAB(5);"##############     ##############":PRINT
9835 PRINTTAB(5);"$$$$$$$$$$$";SPC(7);"$$$$$$$$"
9840 PRINTTAB(2);"3.";SPC(11);"M   4.";SPC(7);"'"
9845 PRINTTAB(4);"'";SPC(12);"M   '";SPC(7);"'$$$$$"
9850 FORJ=1TO2:PRINTTAB(4);"'";SPC(13);"%   '";SPC(13);"%":NEXT
9855 PRINTTAB(4);"'";SPC(13);"%   '";SPC(7);"'#####"
9860 PRINTTAB(4);"'";SPC(13);"%   '";SPC(7);"'"
```

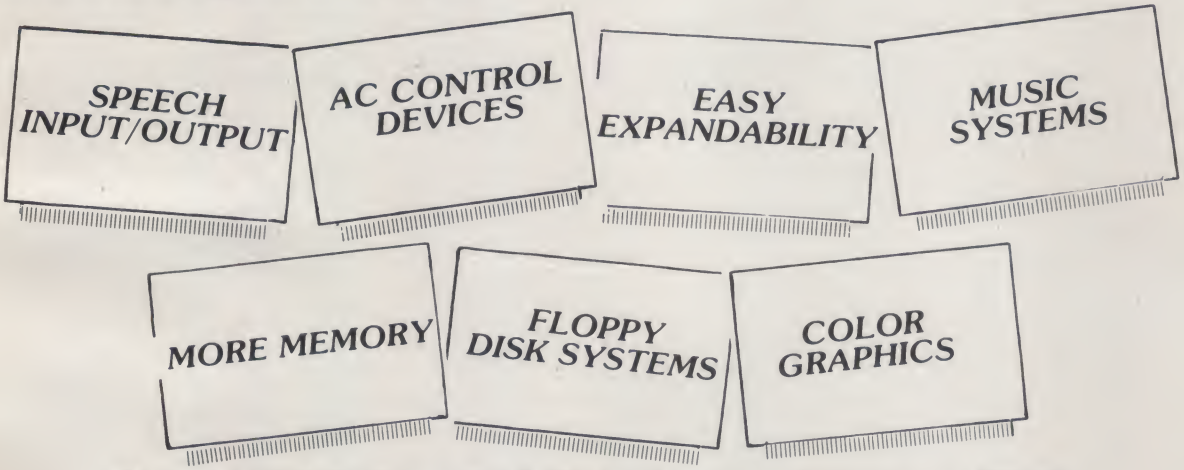


the TR-S100

S-100 BUS INTERFACE TO THE Radio Shack TRS-80

TRS-80 is a product of Radio Shack, A Tandy Corporation

. . . the "breakthrough" for TRS-80 Owners! Now you can make your TRS-80 compatible with the S-100 Bus systems . . opening a whole new world of peripheral devices and applications to you!



We have opened the door to the S-100 world of unique devices for the TRS-80 owner/user. With the TR-S100 you get more than the S-100 interface! We have included sockets for memory expansion up to 32K Bytes. A parallel printer port is provided and provisions have been made for a floppy disk interface (either the 5" mini-floppy of the full size 8"). All this, and software compatibility with the TRS-80 System.

If you already have a TRS-80 expansion chassis, you won't need all the options on our card. But if you have our card, you won't need a TRS-80 expansion chassis. No matter how you put your system together, you can use our card.

For the adventurer, The TR-S100 module allows the TRS-80 to be reconfigured to run software written for the S-100 Bus.

micro computer devices inc.

960 E. Orangethorpe, Bldg. F
Anaheim, California 92801
Telephone (714) 992-2270

✓ M30

mcd

Direct International Sales:
International Sales Division
17648 Orna Drive
Granada Hills, CA 91344, USA

Discounts Available to:
EDUCATIONAL ACCOUNTS
Contact: P.O. Box 8394
Ann Arbor, MI 48105 (313) 665-8514

"Innovators to the Microcomputer Industry"

✓ *Reader Service—see page 179*

```
 9865 PRINTTAB(5);"$$$$$$$$$$$$$$";SPC(5);"$$$$$$$$":PRINT
 9870 PRINTTAB(10);"5. NONE OF THE ABOVE":PRINT:RETURN
 9900 FORJ=1TO3:READM:POKEM,J:POKEM+1,61:NEXT:ONWGOTO9920,9910,9930,9940
 9910 FORJ=4TO6:READM:POKEM,J:POKEM+1,61:NEXT:GOTO9950
 9920 FORJ=1TO4:READM:NEXT:POKEM,4:POKEM+1,61:GOTO9950
 9930 READM:POKEM,J:POKEM+1,61:FORJ=1TO4:READM:NEXT:POKEM,J:POKEM+1,61:GOTO9950
 9940 FORJ=1TO5:READM:NEXT:FORJ=4TO8:READM:POKEM,J:POKEM+1,61:NEXT
 9950 RESTORE:RETURN
 9990 DATA 32862,33168,33462,33283,33116,32994,33203,33000,33394,33358,33203
 9995 DATA 33038,32994,32954
 9999 END
READY.
```

Paint program.

```
BYTES USED= 6202    PROGRAM 3 - PAINT      1/17/79

 400 IFST=0THEN500
 410 PRINT"6cd";TAB(4);"PROGRAM DID NOT LOAD PROPERLY"
 420 PRINT:PRINT:PRINTTAB(4);"REWIND TAPE AND LOAD 'COVER UP'":GOTO9999
 500 CLR:OPEN 1,0,1
 550 G3=1:G4=0:X3$="":PRINT"cs 3cd":PRINTTAB(9);"*** P A I N T ***"
1000 PRINT"3cd";TAB(4);"ENTER NAME OF ROOM: ";:INPUT$1,R$:GOSUB9300
1020 IF U$="N"THENW=5:GOTO1290
1100 GOSUB 9800:PRINT:PRINT"SELECT SHAPE BY NUMBER: ";
1110 G1$="1":G2$="5":GOSUB9200:W=VAL(A$)
1120 IF W=1 THEN W1=4:GOTO1170
1130 IF W=2 THEN W1=6:GOTO1170
1140 IF W=3 THEN W1=5:GOTO1170
1150 IF W=4 THEN W1=8:GOTO1170
1160 IF W=5ANDG4=0THEN1290
1165 Z=0:GOTO2040
1170 GOSUB9360
1200 PRINT"cs":ONWGOSUB9500,9510,9520,9530
1230 GOSUB 9900:GOSUB8000:GOSUB8660:GOSUB9400:IFE$="N"THEN1200
1240 IFG4=1THEN2020
1285 GOTO 1400
1290 G3=2:GOSUB 8100:GOSUB 9410:IF E$="Y" THEN 1400
1300 GOSUB 8140:GOSUB 9410:IF E$="N"THEN1300
1400 IFG4=1THEN2020
1410 PRINT"cs 6cd";TAB(4);"ENTER NUMBER OF DOORS: ";
1415 G1$="0":G2$="9":GOSUB 9200:D=VAL(A$)
1420 PRINT"2cd";TAB(4);"ENTER NUMBER OF WINDOWS: ";:GOSUB9200:F=VAL(A$)
2000 GOSUB7200:GOSUB7000:IFZ=0ANDG4=0THENG4=1:X3$=" CEILING": GOTO1100
2010 IF Z=1THEN2040
2020 GOSUB7000
2040 IFT<1THENGOSUB7800:GOTO500
2050 GOSUB7500:PRINT"cs 6cdARE YOU PAINTING ANOTHER ROOM (Y OR N)?";:G1$="A"
2060 GOSUB 9200:IF A$="Y"THEN500
2070 PRINT"cs 8cd";TAB(2);"TO CONTINUE WITH ANOTHER SELECTION,":PRINT
2080 PRINTTAB(4);"REWIND TAPE AND LOAD 'COVER UP'"
2090 PRINT"4cd";TAB(8);"HAVE A NICE DAY!":PRINT"3cd":GOTO9999
7000 Z=0:ON W GOTO 7020,7030,7040,7060,7025
7020 IFL(1)=L(3)ANDL(2)=L(4)THEN7070
7025 RETURN
7030 IFL(1)+L(5)=L(3)ANDL(4)+L(6)=L(2)THEN7070
7035 RETURN
7040 A=L(2)-L(4):B=L(3)-L(1):C=A^2+B^2:C=INT(SQR(C)+.5)
7050 IFL(5)=C OR L(5)=C-1 OR L(5)=C+1 THEN7070
7055 RETURN
7060 IF L(4)+L(6)+L(8)=L(2) AND L(3)+L(5)=L(1)+L(7)THEN7070
7065 RETURN
7070 Z=1:ONWGOTO7075,7080,7085,7100
7075 C=L(1)*L(2)/144:GOSUB7120:GOTO7110
7080 C1=L(1)*L(2):C2=L(4)*L(5):C=(C1+C2)/144:GOSUB7120:GOTO7110
7085 C1=L(1)*L(2):C2=L(4)*(L(3)-L(1)):C3=SQR((L(3)-L(1))^2+(L(2)-L(4))^2)
7090 C=(C1+C2+C3)/144:GOSUB7120:GOTO7110
7100 C1=L(1)*L(8):C2=L(6)*L(1)+L(7):C3=L(3)*L(4):C=(C1+C2+C3)/144:GOSUB7120
7110 Q3=Q:G3=G:C=A:RETURN
7120 A=C:GOTO7140
7130 A=T
7140 Q=INT(A/100+.999):IFQ>4THEN7160
7150 IFQ<1THENQ=1:GOTO7180
7160 G1=Q/4:G=INT(G1):Q=G1-G:IFQ=0THENGOTO7180
7165 IFQ=.25THENQ=1:GOTO7180
7170 IFQ=.5THENQ=2:GOTO7180
7175 IFQ=.75THENQ=3:GOTO7180
7180 A=INT((A+.05)*10)/10:RETURN
7200 D=D*20:F=F*10:T=0
7210 FOR J=1 TO W1:A(J)=L(J)*H(J)/144:T=T+A(J):NEXT:T=T-(D+F):GOSUB7130
7220 Q2=Q:G2=G:T=A:RETURN
7500 T$=STR$(T):G2$=STR$(G2):Q2$=STR$(Q2)
7510 IFZ=0THENC$=" N/A":G3$=C$:Q3$=C$:GOTO7530
```

```
 9500 GOSUB9600:GOSUB9610:GOSUB9620:GOSUB9630:RETURN
 9510 GOSUB9600:GOSUB9610:GOSUB9640:GOSUB9650:GOSUB9660:GOSUB9670:RETURN
 9520 GOSUB9600:GOSUB9610:GOSUB9640:GOSUB9680:GOSUB9670:RETURN
 9530 GOSUB9670:GOSUB9600:GOSUB9710:RETURN
 9600 FORJ=32934TO33374STEP40:POKEJ,101:NEXT:RETURN
 9610 FORJ=33414TO33441:POKEJ,99:NEXT:RETURN
 9620 FORJ=33401TO32921STEP-40:POKEJ,103:NEXT:RETURN
 9630 FORJ=32894TO32921:POKEJ,100:NEXT:RETURN
 9640 FORJ=33402TO33162STEP-40:POKEJ,101:NEXT:RETURN
 9650 FORJ=33161TO33153STEP-1:POKEJ,99:NEXT:RETURN
 9660 FORJ=33113TO32953STEP-40:POKEJ,101:NEXT:RETURN
 9670 FORJ=32894TO32912:POKE J,100:NEXT:RETURN
 9680 FORJ=33121TO32945STEP-41:POKEJ,77:NEXT
 9700 FOR J=32913TO32916:POKEJ,100:NEXT:RETURN
 9710 FORJ=33414TO33432:POKEJ,99:NEXT
 9720 FORJ=32952TO33072STEP40:POKEJ,103:NEXT
 9725 FORJ=33312TO33392STEP40:POKEJ,103:NEXT
 9730 FORJ=33313TO33321:POKEJ,99:NEXT
 9740 FORJ=33073TO33081:POKEJ,100:NEXT
 9750 FORJ=33122TO33282STEP40:POKEJ,101:NEXT:RETURN
 9800 PRINT"cs":PRINTR$;X3$;" SHAPE IS....":PRINT
 9805 PRINTTAB(5);"$$$$$$$$$$$$$$";SPC(5);"$$$$$$$$"
 9810 PRINTTAB(2);"1.'";SPC(13);"% 2.'";SPC(8);"%"
 9815 FORJ=1TO2:PRINTTAB(4);"'";SPC(13);"%    '";SPC(8);"%":NEXT
 9820 PRINTTAB(4);"'";SPC(13);"%    '";SPC(8);"$$$$$%"
 9825 FORJ=1TO2:PRINTTAB(4);"'";SPC(13);"%    '";SPC(13);"%":NEXT
 9830 PRINTTAB(5);"$$$$$$$$$$$$$$      $$$$$$$$$$$$$$":PRINT
 9835 PRINTTAB(5);"$$$$$$$$$$$$";SPC(7);"$$$$$$$$"
 9840 PRINTTAB(2);"3.'";SPC(11);"M    4.'";SPC(7);"'"
 9845 PRINTTAB(4);"'";SPC(12);"M     '";SPC(7);"'$$$$$"
 9850 FORJ=1TO2:PRINTTAB(4);"'";SPC(13);"%    '";SPC(13);"%":NEXT
 9855 PRINTTAB(4);"'";SPC(13);"%    '";SPC(7);"'$$$$$"
 9860 PRINTTAB(4);"'";SPC(13);"%    '";SPC(7);"'"
 9865 PRINTTAB(5);"$$$$$$$$$$$$$$";SPC(5);"$$$$$$$$":PRINT
 9870 PRINTTAB(10);"5. NONE OF THE ABOVE":PRINT:RETURN
 9900 FORJ=1TO3:READM:POKEM,J:POKEM+1,61:NEXT:ONWGOTO9920,9910,9930,9940
 9910 FORJ=4TO6:READM:POKEM,J:POKEM+1,61:NEXT:GOTO9950
 9920 FORJ=1TO4:READM:NEXT:POKEM,4:POKEM+1,61:GOTO9950
 9930 READM:POKEM,J:POKEM+1,61:FORJ=1TO4:READM:NEXT:POKEM,J:POKEM+1,61:GOTO9950
 9940 FORJ=1TO5:READM:NEXT:FORJ=4TO8:READM:POKEM,J:POKEM+1,61:NEXT
 9950 RESTORE:RETURN
 9990 DATA 32862,33168,33462,33283,33116,32994,33203,33000,33394,33358,33203
 9995 DATA 33038,32994,32954
 9999 END
READY.
```

Paneling program.

```
BYTES FREE= 5662    PROGRAM -4  PANELING      1/17/79

 400 IFST=0THEN500
 410 PRINT"6cd";TAB(4);"PROGRAM DID NOT LOAD PROPERLY"
 420 PRINT:PRINT:PRINTTAB(4);"REWIND TAPE AND LOAD 'COVER UP'":GOTO9999
 500 CLR:OPEN 1,0,1
 550 G3=1:PRINT"cs 3cd":PRINTTAB(6);"*** P A N E L I N G ***"
1000 PRINT"4cd";TAB(4);"ENTER NAME OF ROOM: ";:INPUT$1,R$:GOSUB9300
1010 IFVAL(A1$)>96THENGOSUB7000:GOTO2055
1020 IF U$="N"THENW=5:GOTO1290
1100 GOSUB9800:PRINT:PRINT"SELECT SHAPE BY NUMBER: ";
1110 G1$="1":G2$="5":GOSUB9200:W=VAL(A$)
1120 IFW=1THENW1=4
1130 IFW=2THENW1=6
1140 IFW=3THENW1=5
1150 IFW=4THENW1=8
1160 IFW=5THEN1290
1170 GOSUB9360
1200 PRINT"cs":ONWGOSUB9500,9510,9520,9530
1230 GOSUB9900:GOSUB8000:GOSUB8660:GOSUB9400:IFE$="N"THEN1200
1285 GOTO1400
1290 G3=2:GOSUB8100:IFVAL(A1$)>96THENGOSUB7000:GOTO2055
1295 GOSUB9410:IFE$="Y"THEN1400
1300 GOSUB8140:GOSUB9410:IFE$="N"THEN1300
1400 PRINT"cs 6cd";TAB(4);"ENTER NUMBER OF DOORS: ";:G1$="0":G2$="9"
1410 GOSUB9200:D=VAL(A$)
1420 PRINT"2cd"TAB(4);"ENTER NUMBER OF WINDOWS: ";:GOSUB9200:F=VAL(A$)
1440 PRINT"2cdCOST PER PANEL('0' IF UNKNOWN): ";:GOSUB8300:C$=A$
2000 GOSUB7200:IFP<1THENGOSUB7800:GOTO500
2050 GOSUB7500
2055 PRINT"cs 6cdARE YOU PANELING ANOTHER ROOM (Y OR N)?";:G1$="A"
2060 GOSUB9200:IFA$="Y"THEN500
2070 PRINT"cs 8cd";TAB(2);"TO CONTINUE WITH ANOTHER SELECTION,":PRINT
2080 PRINTTAB(4);"REWIND TAPE AND LOAD 'COVER UP'"
2090 PRINT"4cd";TAB(8);"HAVE A NICE DAY!":PRINT"3cd":GOTO9999
```

```
7520 C$=STR$(C):G3$=STR$(G3):Q3$=STR$(Q3)
7530 PRINT"cs 3cd":PRINTTAB(15-LEN(R$)/2);"*** ";R$;" ***":PRINT
7540 PRINT:PRINTTAB(16);"---AMOUNT OF PAINT @---"
7550 PRINTTAB(9);"SQUARE  400 SQUARE FEET/GALLON"
7560 PRINT"AREA      FEET      GALLONS    QUARTS":FORJ=1TO40:PRINT"C";:NEXT
7570 PRINT:PRINT:PRINT"WALLS";TAB(10);T$;TAB(22);G2$;TAB(32);Q2$
7580 PRINT:PRINT:PRINT"CEILING";TAB(10);C$;TAB(22);G3$;TAB(32);Q3$
7600 PRINT:PRINT:PRINTTAB(5);"TO CONTINUE,PRESS ANY KEY";
7610 GETA$:IF A$=""THEN7610
7620 RETURN
7800 PRINT"cs 6cd":PRINTTAB(2);"FIGURES NOT APPLICABLE AS ENTERED"
7810 PRINT"2cd";TAB(2);"PLEASE CHECK MEASUREMENTS AND REDO":PRINT"2cd":GOTO7600
8000 X$="LENGTH":X1$="WALL":IFG4=1THENX1$="SIDE"
8020 K=65:FORJ=1TO8:B$(J)=CHR$(K):K=K+1:NEXT
8030 PRINT"8cd";TAB(8);X$;"(IN INCHES)"
8040 FORI=1TOW1:PRINT:PRINTTAB(10);X1$;" ";B$(I);"= ";
8050 GOSUB9100:A(I)=VAL(A1$):PRINT:PRINT"3cu"
8060 GOSUB 9250:GOSUB 8500:NEXTI:RETURN
8100 PRINT:PRINT:PRINTTAB(4);"ENTER NUMBER OF WALLS: ";:
8110 G1$="1":G2$="9":GOSUB 9200:W1=VAL(A$):IFU$="Y"THENGOSUB9360
8140 PRINT"cs":PRINTTAB(3);"WALL";TAB(15);"HEIGHT";TAB(28);"LENGTH"
8150 PRINTTAB(12);"(IN INCHES)";TAB(26);"(IN INCHES)"
8160 FORJ=1TO40:PRINT"$";:NEXT:PRINT:PRINT
8170 FORI=1TOW1:PRINTTAB(3);I;TAB(15);
8180 IF U$="N"THENPRINT"?";:GOSUB9100:H(I)=VAL(A1$):GOTO 8200
8190 PRINT H(I);
8200 PRINT:PRINTTAB(28);"cu";"?";:GOSUB9100:L(I)=VAL(A1$):PRINT:PRINT:NEXT
8210 RETURN
8345 IFLEN(A$)>5THEN 8360
8360 FORK=33280TO33327:POKEK,32:NEXTK:FORK=1TOLEN(A$)+1:PRINT"c1";:NEXTK
8370 GOTO8300
8500 ON I GOTO 8510,8520,8530,8540,8580,8610,8630,8640
8510 M=32863:GOTO 8650
8520 M=33169:GOTO 8650
8530 M=33463:GOTO 8650
8540 ON W GOTO8550,8560,8560,8570
8550 M=33204:GOTO 8650
8560 M=33284:GOTO 8650
8570 M=33395:GOTO 8650
8580 IF W=2 THEN M=33117:GOTO 8650
8590 IF W=3 THEN M=33001:GOTO 8650
8600 IF W=4 THEN M=33359:GOTO 8650
8610 IF W=2 THEN M=32995:GOTO 8650
8620 IF W=4 THEN M=33204:GOTO 8650
8630 M=33039:GOTO 8650
8640 M=32995
8650 FORJ=1TOLEN(A1$):POKEM+J,Y(J):NEXT:RETURN
8660 FOR J=1TOW1:L(J)=A(J):NEXT:RETURN
9100 A1$="":K=1
9110 GET A$:IF A$=""THEN9110
9120 IFA$=CHR$(13)THEN9170
9130 IFA$=CHR$(20)THEN Y=0:ONG3GOSUB 9190,9195:GOTO 9100
9135 PRINTA$;:IFA$<"0"ORA$>"9"THENY=1:ONG3GOSUB9190,9195:GOTO 9100
9140 A1$=A1$+A$:A9=VAL(A1$)
9150 IFA9<.9OR A9>720THENY=0:ONG3GOSUB9190,9195:GOTO9100
9160 Y(K)=ASC(A$):K=K+1:GOTO9110
9170 IF LEN(A1$)=0THEN9110
9180 RETURN
9190 GOSUB9250:GOSUB9260:RETURN
9195 GOSUB 9370:RETURN
9200 GET A$:IFA$=""THEN 9200
9205 IF A$=CHR$(13)THEN 9200
9210 IF G1$>"9"THEN 9225
9215 IF A$<G1$ORA$>G2$THEN 9200
9220 GOTO 9230
9225 A$=LEFT$(A$,1):IF A$<>"Y"ANDA$<>"N"THEN9200
9230 PRINTA$:RETURN
9250 FORJ=33225TO33235:POKEJ,32:NEXT:RETURN
9260 FORJ=1TOLEN(A1$)+Y:PRINT"c1";:NEXT:RETURN
9280 FORJ=33136TO33152:POKEJ,32:NEXT
9290 FORJ=33218TO33224:POKEJ,32:NEXT:RETURN
9300 PRINT:PRINT:PRINT
9320 PRINTTAB(1);"IS WALL HEIGHT UNIFORM (Y OR N)? ";:G1$="A"
9330 GOSUB9200:U$=A$:IF U$="N" THEN RETURN
9340 PRINT:PRINT:PRINTTAB(4);"ENTER HEIGHT:":PRINTTAB(4);"(IN INCHES)":PRINT
9350 PRINT"3cu";TAB(18);:G3=2:GOSUB9100:G3=1:RETURN
9360 FORJ=1TOW1:H(J)=VAL(A1$):NEXT:RETURN
9370 FOR J=1TOLEN(A1$)+Y:PRINT"c1";:NEXT
9380 FORJ=1TOLEN(A1$)+Y:PRINTCHR$(32);:NEXT
9390 FORJ=1TOLEN(A1$)+Y:PRINT"c1";:NEXT:RETURN
9400 GOSUB 9280:PRINT:PRINT"8cd":GOTO9420
9410 PRINT:PRINT:PRINT:X$=""
9420 PRINT"ARE ";X$;" ENTRIES CORRECT (Y OR N)? ";:G1$="A"
9430 GOSUB9200:E$=A$:RETURN
```

```
7000 PRINT"cs 4cd":PRINTTAB(5);"STANDARD PANEL HEIGHT IS":PRINT
7010 PRINTTAB(8);"96 INCHES (8 FEET)":PRINT:PRINT:PRINT:PRINT
7020 PRINTTAB(8);"FOR OVERSIZE WALLS,":PRINT
7030 PRINTTAB(2);"CONSULT A HOME DECORATION CENTER":GOTO7600
7200 P=0:X=.67:IFH(1)<=48THENX=.33
7205 FORJ=1TOW1:IFW<>5THENP=P+L(J):GOTO7230
7210 P(J)=L(J)/48:IFH(J)<=48THENP(J)=P(J)/2:X=.33
7220 P=P+P(J)
7230 NEXT:IFW<>5THENP=P/48
7240 P=P-((D*X)+(F*.5)):P=INT(P*10)/10+.9:P=INT(P)
7250 IFW<>5ANDH(1)<=48THENP=INT(P/2+.5)
7260 IFC$="0"THENC$="  N/A":GOTO7280
7270 C=VAL(C$):C=C*P:C1$=STR$(C):B$="$":C$=B$+C1$
7280 P1=0:FORJ=1TOW1:P1=P1+L(J):NEXT:P1=INT(P1/12*10+.5)/10:RETURN
7500 PRINT"cs":PRINTTAB(15-(LEN(R$)/2));"+++ ";R$;" +++":PRINT"4cd"
7510 PRINTTAB(2);"WALL";SPC(11);"NUMBER OF";SPC(6);"TOTAL"
7520 PRINT"PERIMETER";SPC(9);"PANELS";SPC(8);"COST"
7530 FORJ=1TO40:PRINT"D";:NEXT:PRINT:PRINT
7540 PRINTP1;" FEET";TAB(19);P;TAB(31);C$
7600 PRINT"6cd":PRINTTAB(5);"TO CONTINUE,PRESS ANY KEY";
7610 GETA$:IF A$=""THEN7610
7620 RETURN
7800 PRINT"cs 6cd":PRINTTAB(2);"FIGURES NOT APPLICABLE AS ENTERED"
7810 PRINT"2cd";TAB(2);"PLEASE CHECK MEASUREMENTS AND REDO":PRINT"2cd":GOTO7600
8000 X$="LENGTH":K=65:FORJ=1TO8:B$(J)=CHR$(K):K=K+1:NEXT
8030 PRINT"8cd";TAB(8);X$;"(IN INCHES)"
8040 FORI=1TOW1:PRINT:PRINTTAB(10);"WALL ";B$(I);"= ";
8050 GOSUB9100:A(I)=VAL(A1$):PRINT:PRINT"3cu"
8060 GOSUB 9250:GOSUB 8500:NEXTI:RETURN
8100 PRINT:PRINT:PRINTTAB(4);"ENTER NUMBER OF WALLS: ";:
8110 G1$="1":G2$="9":GOSUB 9200:W1=VAL(A$):IFU$="Y"THENGOSUB9360
8140 PRINT"cs":PRINTTAB(3);"WALL";TAB(15);"HEIGHT";TAB(28);"LENGTH"
8150 PRINTTAB(12);"(IN INCHES)";TAB(26);"(IN INCHES)"
8160 FORJ=1TO40:PRINT"$";:NEXT:PRINT:PRINT
8170 FORI=1TOW1:PRINTTAB(3);I;TAB(15);
8180 IFU$="N"THENPRINT"?";:GOSUB9100:H(I)=VAL(A1$):GOTO8200
8190 PRINTH(I);
8200 IF VAL(A1$)>96THENRETURN
8205 PRINT:PRINTTAB(28);"cu";"?";:GOSUB9100:L(I)=VAL(A1$):PRINT:PRINT:NEXT
8210 RETURN
8300 INPUT$1,A$:IFA$=CHR$(13)THENPRINT" cu";:GOTO8360
8320 FORJ=1TOLEN(A$):A1$=MID$(A$,J,1):IFA1$="."THEN 8340
8330 IFA1$<CHR$(48)ORA1$>CHR$(57)THEN 8360
8340 NEXTJ:A=VAL(A$):IFA<0ORA>99.99THEN8360
8345 IFLEN(A$)>5THEN8360
8350 RETURN
8360 FORK=33280TO33322:POKEK,32:NEXTK:FORK=1TOLEN(A$)+1:PRINT"c1";:NEXTK
8370 GOTO8300
8500 ONIGOTO 8510,8520,8530,8540,8580,8610,8630,8640
8510 M=32863:GOTO 8650
8520 M=33169:GOTO 8650
8530 M=33463:GOTO8650
8540 ON W GOTO8550,8560,8560,8570
8550 M=33204:GOTO 8650
8560 M=33284:GOTO 8650
8570 M=33395:GOTO8650
8580 IFW=2THENM=33117:GOTO8650
8590 IFW=3THENM=33001:GOTO8650
8600 IFW=4THENM=33359:GOTO8650
8610 IFW=2THENM=32995:GOTO8650
8620 IFW=4THENM=33204:GOTO8650
8630 M=33039:GOTO8650
8640 M=32995
8650 FORJ=1TOLEN(A1$):POKEM+J,Y(J):NEXT:RETURN
8660 IF X$="LENGTH"THEN FOR J=1TOW1:L(J)=A(J):NEXT:RETURN
9100 A1$="":K=1
9110 GETA$:IFA$=""THEN9110
9120 IFA$=CHR$(13)THEN9170
9130 IFA$=CHR$(20)THENY=0:ONG3GOSUB9190,9195:GOTO9100
9135 PRINTA$;:IFA$<"0"ORA$>"9"THENY=1:ONG3GOSUB9190,9195:GOTO 9100
9140 A1$=A1$+A$:A9=VAL(A1$)
9150 IFA9<.9OR A9>720THENY=0:ONG3GOSUB9190,9195:GOTO9100
9160 Y(K)=ASC(A$):K=K+1:GOTO9110
9170 IF LEN(A1$)=0THEN9110
9180 RETURN
9190 GOSUB9250:GOSUB9260:RETURN
9195 GOSUB9370:RETURN
9200 GETA$:IFA$=""THEN9200
9205 IFA$=CHR$(13)THEN 9200
9210 IFG1$>"9"THEN 9225
9215 IF A$<G1$ORA$>G2$THEN 9200
9220 GOTO9230
9225 A$=LEFT$(A$,1):IF A$<>"Y"ANDA$<>"N"THEN9200
9230 PRINTA$:RETURN
9250 FORJ=33225TO33235:POKEJ,32:NEXT:RETURN
```

```
9260 FORJ=1TOLEN(A1$)+Y:PRINT"cl";:NEXT:RETURN
9280 FORJ=33136TO33152:POKEJ,32:NEXT
9290 FORJ=33218TO33224:POKEJ,32:NEXT:RETURN
9300 PRINT:PRINT:PRINT
9320 PRINTTAB(1);"IS WALL HEIGHT UNIFORM (Y OR N)? ";:G1$="A"
9330 GOSUB9200:U$=A$:IF U$="N" THEN RETURN
9340 PRINT:PRINT:PRINTTAB(4);"ENTER HEIGHT:";:PRINTTAB(4);"(IN INCHES)":PRINT
9350 PRINT"3cu";TAB(18);:G3=2:GOSUB9100:G3=1:RETURN
9360 FORJ=1TOW1:H(J)=VAL(A1$):NEXT:RETURN
9370 FORJ=1TOLEN(A1$)+Y:PRINT"cl";:NEXT
9380 FORJ=1TOLEN(A1$)+Y:PRINTCHR$(32);:NEXT
9390 FORJ=1TOLEN(A1$)+Y:PRINT"cl";:NEXT:RETURN
9400 GOSUB9280:PRINT:PRINT"8cd":GOTO9420
9410 PRINT:PRINT:PRINT:X$=""
9420 PRINT"ARE ";X$;" ENTRIES CORRECT (Y OR N)? ";:G1$="A"
9430 GOSUB9200:E$=A$:RETURN
9500 GOSUB9600:GOSUB9610:GOSUB9620:GOSUB9630:RETURN
9510 GOSUB9600:GOSUB9610:GOSUB9640:GOSUB9650:GOSUB9660:GOSUB9670:RETURN
9520 GOSUB9600:GOSUB9610:GOSUB9640:GOSUB9680:GOSUB9670:RETURN
9530 GOSUB9670:GOSUB9600:GOSUB9710:RETURN
9600 FORJ=32934TO33374STEP40:POKEJ,101:NEXT:RETURN
9610 FORJ=33414TO33441:POKEJ,99:NEXT:RETURN
9620 FORJ=33401TO32921STEP-40:POKEJ,103:NEXT:RETURN
9630 FORJ=32894TO32921:POKEJ,100:NEXT:RETURN
9640 FORJ=33402TO33162STEP-40:POKEJ,101:NEXT:RETURN
9650 FORJ=33161TO33153STEP-1:POKEJ,99:NEXT:RETURN
9660 FORJ=33113TO32953STEP-40:POKEJ,101:NEXT:RETURN
9670 FORJ=32894TO32912:POKE J,100:NEXT:RETURN
9680 FORJ=33121TO32945STEP-41:POKEJ,77:NEXT
9700 FOR J=32913TO32916:POKEJ,100:NEXT:RETURN
9710 FORJ=33414TO33432:POKEJ,99:NEXT
9720 FORJ=32952TO33072STEP40:POKEJ,103:NEXT
9725 FORJ=33312TO33392STEP40:POKEJ,103:NEXT
9730 FORJ=33313TO33321:POKEJ,99:NEXT
9740 FORJ=33073TO33081:POKEJ,100:NEXT
9750 FORJ=33122TO33282STEP40:POKEJ,101:NEXT:RETURN
9800 PRINT"cs":PRINTR$;" SHAPE IS....":PRINT
9805 PRINTTAB(5);"$$$$$$$$$$$$$$";SPC(5);"$$$$$$$$"
9810 PRINTTAB(2);"1.'";SPC(13);"% 2.'";SPC(8);"%"
9815 FORJ=1TO2:PRINTTAB(4);"'";SPC(13);"%    '";SPC(8);"%":NEXT
9820 PRINTTAB(4);"'";SPC(13);"%    '";SPC(8);"$$$$$%"
9825 FORJ=1TO2:PRINTTAB(4);"'";SPC(13);"%    '";SPC(13);"%":NEXT
9830 PRINTTAB(5);"$$$$$$$$$$$$$$     $$$$$$$$$$$$$$":PRINT
9835 PRINTTAB(5);"$$$$$$$$$$$";SPC(7);"$$$$$$$$"
9840 PRINTTAB(2);"3.'";SPC(11);"%   4.'";SPC(7);"'"
9845 PRINTTAB(4);"'";SPC(12);"%    '";SPC(7);"'$$$$$"
9850 FORJ=1TO2:PRINTTAB(4);"'";SPC(13);"%    '";SPC(13);"%":NEXT
9855 PRINTTAB(4);"'";SPC(13);"%    '";SPC(7);"'$$$$$"
9860 PRINTTAB(4);"'";SPC(13);"%    '";SPC(7);"'"
9865 PRINTTAB(5);"$$$$$$$$$$$$$$";SPC(5);"$$$$$$$$":PRINT
9870 PRINTTAB(10);"5. NONE OF THE ABOVE":PRINT:RETURN
9900 FORJ=1TO3:READM:POKEM,J:POKEM+1,61:NEXT:ONWGOTO9920,9910,9930,9940
9910 FORJ=4TO6:READM:POKEM,J:POKEM+1,61:NEXT:GOTO9950
9920 FORJ=1TO4:READM:NEXT:POKEM,4:POKEM+1,61:GOTO9950
9930 READM:POKEM,J:POKEM+1,61:FORJ=1TO4:READM:NEXT:POKEM,J:POKEM+1,61:GOTO9950
9940 FORJ=1TO5:READM:NEXT:FORJ=4TO8:READM:POKEM,J:POKEM+1,61:NEXT
9950 RESTORE:RETURN
9990 DATA 32862,33168,33462,33283,33116,32994,33203,33000,33394,33358,33203
9995 DATA 33038,32994,32954
9999 END
READY.
```

Carpet program.

```
BYTES USED= 5736      PROGRAM 5 - CARPET     1/17/79

 400 IF ST=0 THEN 500
 410 PRINT"6cd";TAB(4);"PROGRAM DID NOT LOAD PROPERLY"
 420 PRINT:PRINT:PRINTTAB(4);"REWIND TAPE AND LOAD 'COVER UP'":GOTO9999
 500 CLR:OPEN 1,0,1
 550 G3=1:PRINT"cs 3cd":PRINTTAB(8);"*** C A R P E T ***"
1000 PRINT"6cd":PRINTTAB(4);"ENTER NAME OF ROOM: ";:INPUT$1,R$
1100 GOSUB 9800:PRINT:PRINT"SELECT SHAPE BY NUMBER: ";
1110 G1$="1":G2$="5":GOSUB9200:W=VAL(A$)
1120 IF W=5THEN GOSUB 7900:GOTO 2050
1130 IF W=1 THEN W1=4:GOTO1200
1140 IF W=2 THEN W1=6:GOTO1200
1150 IF W=3 THEN W1=5:GOTO1200
1160 IF W=4 THEN W1=8
1200 PRINT"cs":ONWGOSUB9500,9510,9520,9530
1230 GOSUB 9900:GOSUB8000:GOSUB8660:GOSUB9400:IFE$="N"THEN1200
1300 PRINT"cs 7cd":PRINTTAB(2);"ENTER COST PER SQUARE YARD: ":PRINT
1310 PRINTTAB(3);"('0' IF UNKNOWN)";:PRINT"2cu";TAB(30);:GOSUB8300:M$=A$
2000 GOSUB7000:IFZ=0THENGOSUB7800:GOTO1100
2010 IFA<1THENGOSUB7800:GOTO500
2020 GOSUB7200
2030 IF F=1 THEN 2050
2040 GOSUB 7500
2050 PRINT"cs 7cdARE YOU CARPETING ANOTHER ROOM (Y OR N)?";:G1$="A"
2060 GOSUB 9200:IF A$="Y"THEN500
2070 PRINT"cs 8cd";TAB(2);"TO CONTINUE WITH ANOTHER SELECTION,":PRINT
2080 PRINT:PRINTTAB(4);"REWIND TAPE AND LOAD 'COVER UP'"
2090 PRINT"2cd";TAB(8);"HAVE A NICE DAY!":PRINT"3cd":GOTO9999
7000 Z=0:ON W GOTO 7020,7030,7040,7060,7025
7020 IFL(1)=L(3)ANDL(2)=L(4)THEN7070
7025 RETURN
7030 IFL(1)+L(5)=L(3)ANDL(4)+L(6)=L(2)THEN7070
7035 RETURN
7040 A=L(2)-L(4):B=L(3)-L(1):C=A^2+B^2:C=INT(SQR(C)+.5)
7050 IFL(5)=C OR L(5)=C-1 OR L(5)=C+1 THEN7070
7055 RETURN
7060 IF L(4)+L(6)+L(8)=L(2) AND L(3)+L(5)=L(1)+L(7)THEN7070
7065 RETURN
7070 Z=1:ONWGOTO7075,7080,7085,7100
7075 A=L(1)*L(2)/144/9:GOSUB7120:GOTO7110
7080 C1=L(1)*L(2):C2=L(4)*L(5):A=(C1+C2)/144/9:GOSUB7120:GOTO7110
7085 C1=L(1)*L(2):C2=L(4)*(L(3)-L(1)):C3=SQR((L(3)-L(1))^2+(L(2)-L(4))^2)
7090 A=(C1+C2+C3)/144/9:GOSUB7120:GOTO7110
7100 C1=L(1)*L(8):C2=L(6)*(L(1)+L(7)):C3=L(3)*L(4)
7105 A=(C1+C2+C3)/144/9:GOSUB 7120
7110 A=A1:RETURN
7120 A1=A:GOTO7140
7130 A1=C
7140 A1=INT((A1+.05)*10)/10:RETURN
7200 F=0:N=144:X9=L(2):IF W=4THEN7220
7210 Y9=L(3):GOTO7230
7220 Y9=L(3)+L(5)
7230 IFX9>180ANDY9>180THENGOSUB7400:RETURN
7240 IFX9>NANDY9>NTHENN=180
7250 IFX9<=NANDY9<=NTHEN7300
7260 IFX9>NANDY9<=NTHEN7350
7270 IFY9>NANDX9<=NTHEN7360
7300 IFX9>= Y9THEN7360
7350 C=N*X9/144/9:GOTO7370
7360 C=N*Y9/144/9
7370 GOSUB7130:C=INT(A1+.99):N=N/12:M=VAL(M$):IFM=0THENM1$="  N/A":RETURN
7380 M=M*C:D$="$":M$=STR$(M):M1$=D$+M$:RETURN
7400 PRINT"cs 5cd":PRINTTAB(5);"ROOM DIMENSIONS TOO LARGE"
7410 PRINT:PRINTTAB(5);"FOR STANDARD CARPET WIDTHS"
7420 PRINT"3cd":PRINTTAB(5);"CONSULT A CARPET DEALER":F=1
7430 PRINT"2cd":GOTO7600
7500 PRINT"cs 2cd":PRINTTAB(15-INT(LEN(R$)/2));"*** ";R$;" ***":PRINT"3cu"
7510 PRINTTAB(1);"SQ.YARDS";SPC(3);"MAXIMUM CARPET";SPC(4);"MAXIMUM"
7520 PRINTTAB(1);"OF AREA";SPC(3);N;" FOOT WIDTH";SPC(6);"COST"
7530 FORJ=1TO40:PRINT"C";:NEXT:PRINT:PRINT
7540 PRINTTAB(1);A;TAB(12);C;" SQ.YARDS";TAB(29);M1$
7550 PRINT"4cd"
7600 PRINT:PRINT:PRINTTAB(5);"TO CONTINUE,PRESS ANY KEY";
7610 GETA$:IF A$=""THEN7610
7620 RETURN
7800 PRINT"cs 6cd":PRINTTAB(2);"FIGURES NOT APPLICABLE AS ENTERED"
7810 PRINT"2cd";TAB(2);"PLEASE CHECK MEASUREMENTS AND REDO":PRINT"2cd":GOTO7600
7900 PRINT"cs 10cd":PRINTTAB(7);"CHOICE NOT APPLICABLE"
7910 FORJ=1TO2000:NEXT:RETURN
8000 X$="LENGTH":X1$="WALL":IFG4=1THENX1$="SIDE"
8020 K=65:FORJ=1TO8:B$(J)=CHR$(K):K=K+1:NEXT
8030 PRINT"8cd";TAB(8);X$;"(IN INCHES)"
8040 FORI=1TOW1:PRINT:PRINTTAB(10);X1$;" ";B$(I);"= ";
8050 GOSUB9100:A(I)=VAL(A1$):PRINT:PRINT"3cu"
8060 GOSUB 9250:GOSUB 8500:NEXTI:RETURN
8300 INPUT$1,A$
8310 IFA$=CHR$(13)THENPRINT"cu";:GOTO8360
8320 FORJ=1TOLEN(A$):A1$=MID$(A$,J,1):IFA1$=CHR$(46)THEN8340
8330 IFA1$<"0"ORA1$>"9"THEN8360
8340 NEXT:A=VAL(A$):IFA>99.99THEN8360
8345 IFLEN(A$)>5THEN 8360
8350 RETURN
8360 FORK=33118TO33158:POKEK,32:NEXTK:FORK=1TOLEN(A$)+1:PRINT"cl";:NEXTK
8370 GOTO8300
8500 ON I GOTO 8510,8520,8530,8540,8580,8610,8630,8640
8510 M=32863:GOTO 8650
8520 M=33169:GOTO 8650
8530 M=33463:GOTO 8650
8540 ON W GOTO8550,8560,8560,8570
8550 M=33204:GOTO 8650
8560 M=33284:GOTO 8650
8570 M=33395:GOTO 8650
```

```
8580 IF W=2 THEN M=33117:GOTO 8650
8590 IF W=3 THEN M=33001:GOTO 8650
8600 IF W=4 THEN M=33359:GOTO 8650
8610 IF W=2 THEN M=32995:GOTO 8650
8620 IF W=4 THEN M=33204:GOTO 8650
8630 M=33039:GOTO 8650
8640 M=32995
8650 FORJ=1TOLEN(A1$):POKEM+J,Y(J):NEXT:RETURN
8660 FOR J=1TOW1:L(J)=A(J):NEXT:RETURN
9100 A1$="":K=1
9110 GET A$:IF A$=""THEN9110
9120 IFA$=CHR$(13)THEN9170
9130 IFA$=CHR$(20)THEN Y=0:ONG3GOSUB 9190,9195:GOTO 9100
9135 PRINTA$;:IFA$<"0"ORA$>"9"THENY=1:ONG3GOSUB9190,9195:GOTO 9100
9140 A1$=A1$+A$:A9=VAL(A1$)
9150 IFA9<.9OR A9>720THENY=0:ONG3GOSUB9190,9195:GOTO9100
9160 Y(K)=ASC(A$):K=K+1:GOTO9110
9170 IF LEN(A1$)=0THEN9110
9180 RETURN
9190 GOSUB9250:GOSUB9260:RETURN
9195 GOSUB 9370:RETURN
9200 GET A$:IFA$=""THEN 9200
9205 IF A$=CHR$(13)THEN 9200
9210 IF G1$>"9"THEN 9225
9215 IF A$<G1$OR A$>G2$THEN 9200
9220 GOTO 9230
9225 A$=LEFT$(A$,1):IF A$<>"Y"ANDA$<>"N"THEN9200
9230 PRINTA$:RETURN
9250 FORJ=33225TO33235:POKEJ,32:NEXT:RETURN
9260 FORJ=1TOLEN(A1$)+Y:PRINT"c1";:NEXT:RETURN
9280 FORJ=33136TO33152:POKEJ,32:NEXT
9290 FORJ=33218TO33224:POKEJ,32:NEXT:RETURN
9370 FOR J=1TOLEN(A1$)+Y:PRINT"c1";:NEXT
9380 FORJ=1TOLEN(A1$)+Y:PRINTCHR$(32);:NEXT
9390 FORJ=1TOLEN(A1$)+Y:PRINT"c1";:NEXT:RETURN
9400 GOSUB 9280:PRINT:PRINT"Bcd":GOTO9420
9410 PRINT:PRINT:PRINT"X$=""
9420 PRINT"ARE "X$;" ENTRIES CORRECT (Y OR N)? ";:G1$="A"
9430 GOSUB9200:E$=A$:RETURN
9500 GOSUB9600:GOSUB9610:GOSUB9620:GOSUB9630:RETURN
9510 GOSUB9600:GOSUB9610:GOSUB9640:GOSUB9650:GOSUB9660:GOSUB9670:RETURN
9520 GOSUB9600:GOSUB9610:GOSUB9640:GOSUB9680:GOSUB9670:RETURN
9530 GOSUB9670:GOSUB9600:GOSUB9710:RETURN
9600 FORJ=32934TO33374STEP40:POKEJ,101:NEXT:RETURN
9610 FORJ=33414TO33441:POKEJ,99:NEXT:RETURN
9620 FORJ=33401TO32921STEP-40:POKEJ,103:NEXT:RETURN
9630 FORJ=32894TO32921:POKEJ,100:NEXT:RETURN
9640 FORJ=33402TO33162STEP-40:POKEJ,101:NEXT:RETURN
9650 FORJ=33161TO33153STEP-1:POKEJ,99:NEXT:RETURN
9660 FORJ=33113TO32953STEP-40:POKEJ,101:NEXT:RETURN
9670 FORJ=32894TO32912:POKE J,100:NEXT:RETURN
9680 FORJ=33121TO32945STEP-1:POKEJ,77:NEXT
9700 FOR J=32913TO32916:POKEJ,100:NEXT:RETURN
9710 FORJ=33414TO33432:POKEJ,99:NEXT
9720 FORJ=32952TO33072STEP40:POKEJ,103:NEXT
9725 FORJ=33312TO33392STEP40:POKEJ,103:NEXT
9730 FORJ=33313TO33321:POKEJ,99:NEXT
9740 FORJ=33073TO33081:POKEJ,100:NEXT
9750 FORJ=33122TO33282STEP40:POKEJ,101:NEXT:RETURN
9800 PRINT"cs":PRINTR$;X3$;" SHAPE IS ";:PRINT
9805 PRINTTAB(5);"$$$$$$$$$$$$$";SPC(5);"$$$$$$$"
9810 PRINTTAB(2);"1,";SPC(13);"2,";SPC(8);"2"
9815 FORJ=1TO2:PRINTTAB(4);"  ";SPC(13);"%   ";SPC(8);"%":NEXT
9820 PRINTTAB(4);"  ";SPC(13);"%   ";SPC(8);"#####%"
9825 FORJ=1TO2:PRINTTAB(4);"  ";SPC(13);"%   ";SPC(13);"%":NEXT
9830 PRINTTAB(5);"##############   ##############":PRINT
9835 PRINTTAB(5);"$$$$$$$$$";SPC(7);"$$$$$$$"
9840 PRINTTAB(2);"3,";SPC(11);"M   4,";SPC(7);","
9845 PRINTTAB(4);"  ";SPC(12);"M   ";SPC(7);"$$$$$"
9850 FORJ=1TO2:PRINTTAB(4);"  ";SPC(13);"%   ";SPC(13);"%":NEXT
9855 PRINTTAB(4);"  ";SPC(13);"%   ";SPC(7);"#####"
9860 PRINTTAB(4);"  ";SPC(13);"%   ";SPC(7);","
9865 PRINTTAB(5);"##########   ";SPC(5);"########":PRINT
9870 PRINTTAB(10);"5, NONE OF THE ABOVE":PRINT:RETURN
9900 FORJ=1TO3:READM:POKEM,J:POKEM+1,61:NEXT:ONWGOTO9920,9910,9930,9940
9910 FORJ=4TO6:READM:POKEM,J:POKEM+1,61:NEXT:GOTO9950
9920 FORJ=1TO4:READM:NEXT:POKEM,4:POKEM+1,61:GOTO9950
9930 READM:POKEM+J:POKEM+1,61:FORJ=1TO4:READM:NEXT:POKEM,J:POKEM+1,61:GOTO9950
9940 FORJ=1TO5:READM:NEXT:FORJ=4TO8:READM:POKEM,J:POKEM+1,61:NEXT
9950 RESTORE:RETURN
9990 DATA 32862,33168,33462,33283,33116,32994,33203,33000,33394,33358,33203
9995 DATA 33038,32994,32954
9999 END
READY.
```


✓ Reader Service—see page 179

David G. Morr
6599 Red Fox Rd.
Reynoldsburg OH 43068

Teleprinter Output for TRS-80

This method of adding teleprinter output control to the TRS-80 uses hardware and software.

This article presents a low-cost method of adding teleprinter output control to a TRS-80 Level II computer. The Radio Shack expansion interface is not required, and the interface described in this article is very low cost. The teleprinter is automatically linked to Level II BASIC so that the LLIST and LPRINT commands affect the teleprinter in the same manner as the Radio Shack line printer is affected.

Background

One of the first things I did upon receiving my Level II upgrade was to examine the accompanying manual. In spite of my high interest in the new BASIC, the first thing that caught my eye was the memory map in the appendices. Right there in black and white was enough detail for me to formulate plans for connecting my Baudot-coded teleprinter to the TRS-80 for hard-copy output.

The item that started my ensuing design was the definition in the memory map of *device control blocks*. Basically, a device control block for the TRS-80 contains eight bytes of reserved RAM that are used to define the software hooks for a particular input/output device. In the non-disk Level II systems, three such blocks are defined—keyboard input, device output (video display) and printer output (line printer). Each block is rigidly defined as to what each byte means to the system software.

In each block the first byte defines the type of block; the next two bytes define the software driver address for the particular I/O device; the next three bytes of each block are used for uniquely defined constants or counters used by the software driver; and the last two bytes contain the ASCII values of two letters that identify what the block is used for. Fig. 1 shows how the device control block for the line printer is defined in the manual and also what values are loaded into these RAM locations when the TRS-80 is first powered up.

Using the driver address as shown in Fig. 1 and the disassembler function of the RSM-1S monitor software from Small Systems Software (an excellent piece of software for a fair price), I then investigated how the software driver was used by the system.

When the routine is called, a character to be printed is contained in the C register of the Z-80 CPU. The routine checks the value of the character to see if a control function is to be performed, does that function if required and then returns to the calling program. If the character is printable, then the character will be output to the line printer.

In either case the software driver determines what action is to be taken and then continually tests a line printer status address for an indication that the printer is ready. This last statement indicates why the computer hangs up in an endless loop when the LPRINT or LLIST commands are executed when no line printer is attached.

At this point I had sufficient information on how the TRS-80 handled its I/O functions to write my own software driver for printed output on a teleprinter. But, I had no way of electrically connecting a teleprinter to the computer.

After considering the technical aspects of interfacing a hardware UART to the 40-pin expansion connector, the cost of the hardware and the remaining need for interface software, I decided in favor of using the cassette interface as a less expensive choice for a serial output to a teleprinter. My first interface was simplicity personified! A battery and a relay as shown in Fig. 2 were all I required.

In Fig. 2 the relay is operated by operating the relay within the computer that is normally used to operate the cassette motor. The normally closed contact of the interface relay puts the TTY current loop in a marking state as its normal state. Issuing a value of 4 to output port 0FFH turns on the cassette motor relay, operates the interface relay and opens the current loop. An open current loop is in the spacing state.

The Fig. 2 interface worked fine, but then I heard dire warnings from Radio Shack of early cassette motor relay fatigue. In order to avoid having to replace the internal TRS-80 relay someday, I searched for a better method.

Hardware

Fig. 3 shows what I consider —after investigating several other alternatives—to be the

Hexadecimal Address	Use	Hexadecimal Values Loaded at Power-Up	Values Changed by LOAD Routine
4025	DCB Type	06	
4026	Driver Address (LSB)	8D	B0
4027	Driver Address (MSB)	05	7E
4028	Lines/Page	43	
4029	Line Counter	00	
402A	Chars/Line **	00	48
402B	ASCII 'P'	50	
402C	ASCII 'R'	52	

** Characters/Line—Initially no definition, defined by LOAD

Fig. 1. TRS-80 line printer device control block.

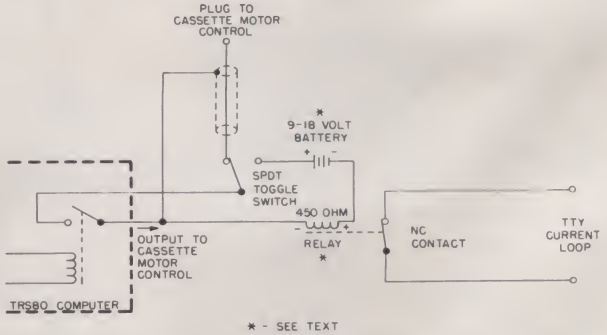


Fig. 2. Initial interface.

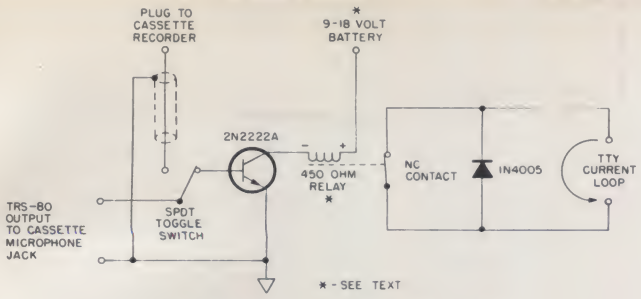


Fig. 3. Recommended interface.

least expensive and most reliable interface. In addition to what is shown in Fig. 2, this interface uses a "garden variety" transistor and a diode. Instead of using the cassette motor relay inside the TRS-80, Fig. 3 uses the audio output normally used for writing data to the cassette. This audio output, when not being used for cassette output, normally rests at .45 volts dc.

If the value of 1 is put to output port 0FFH, then the cassette audio output will rise to about .85 volts dc. This voltage range combined with Radio Shack's fortunate choice of resistance values allows the use of a simple NPN transistor to control the interface relay.

The advantage of the Fig. 3 interface is that possible cassette motor relay failure is prevented. The diode is used to reduce voltage spikes that could eventually destroy the interface relay contact. If you do not have a current supply for your teleprinter loop, then this function, plus an adjustable rheostat for obtaining the proper loop current, will have to be added.

The relay used in Fig. 2 or 3 must have fast operate and release times (1 to 2 ms range) and have a mercury-wetted, normally closed contact. This kind of relay, which will operate at low voltage, is usually expen-

Fig. 5. Software listing.

```
                        00100
                        00110 ;       PRINTER OUTPUT ROUTINE FOR TRS80
                        00120
                        00130 ;       AUTHOR - DAVID G. MORR
                        00140
                        00150
                        00160 ;       REQUIREMENTS:   LEVEL II BASIC
                        00170 ;                       16K RAM
                        00180 ;                       INTERFACE TO CASSETTE AUDIO OUTPUT
                        00190 ;                       BAUDOT CODED TELEPRINTER (5 LEVEL)
                        00200
                        00210 ;       LAST REVISION DATE - 9/30/1978
                        00220
                        00230
7E9A                    00240         ORG     7E9AH   ;INITIALIZE DEVICE CONTROL BLOCK
7E9A 21A87E             00250 LOAD    LD      HL,LPRT
7E9D 222640             00260         LD      (4026H),HL
7EA0 3E48               00270         LD      A,72D   ;SET CHAR COUNT TO 72
7EA2 322A40             00280         LD      (402AH),A
7EA5 76                 00290         HALT            ;BACK TO BASIC
                        00300
7EA8                    00310         ORG     7EA8H   ;ORIGIN OF LINE PRINTER ROUTINE
7EA8 ED73FC7F           00320 LPRT    LD      (SAVSTK),SP ;SAVE CURRENT CALLING SP
7EAC DD212540           00330         LD      IX,4025H ;INITIALIZE DC8 POINTER
7EB0 79                 00340         LD      A,C     ;RETURN IF 0
7EB1 B7                 00350         OR      A
7EB2 C8                 00360         RET     Z
7EB3 FE21               00370         CP      33D     ;CHECK FOR NON-CONTROL
7EB5 3053               00380         JR      NC,ALPHA
7EB7 FE0D               00390         CP      13D     ;CHECK FOR CARRIAGE RETURN
7EB9 282C               00400         JR      Z,CRLF
7EBB FE0A               00410         CP      10D     ;CHECK FOR LINE FEED
7EBD 2842               00420         JR      Z,LF
7EBF FE0B               00430         CP      11D     ;CHECK FOR VERTICAL TAB
7EC1 2811               00440         JR      Z,VERTAB
7EC3 FE0C               00450         CP      12D     ;CHECK FOR FORM FEED
7EC5 2808               00460         JR      Z,FRMFD
7EC7 FE20               00470         CP      32D     ;CHECK FOR SPACE CHARACTER
7EC9 C0                 00480         RET     NZ      ;RETURN IF NOT APPLICABLE
7ECA 3E04               00490 SPCHR   LD      A,4     ;PRINT SPACE CODE
7ECC C3687F             00500         JP      PRINT
                        00510
7ECF AF                 00520 FRMFD   XOR     A       ;CHECK FOR 0 LINES PER PAGE
7ED0 DD8603             00530         OR      (IX+3)
7ED3 C8                 00540         RET     Z       ;IGNORE IF ZERO
7ED4 DD7E03             00550 VERTAB  LD      A,(IX+3) ;LINES/PAGE TO ACCUM.
7ED7 DD9604             00560         SUB     (IX+4)  ;SUBTRACT ACTURAL LINE COUNT
7EDA 47                 00570         LD      B,A     ;LINE FEED COUNTER TO B
7EDB C5                 00580 VT1     PUSH    BC
7EDC CD017F             00590         CALL    LF      ;DO A LINE FEED
7EDF C1                 00600         POP     BC
7EE0 10F9               00610         DJNZ    VT1
7EE2 DD360400           00620         LD      (IX+4),0 ;0 TO ACTURAL LINE COUNT
7EE6 C9                 00630         RET
                        00640
7EE7 DD3404             00650 CRLF    INC     (IX+4)  ;INCREMENT LINE COUNTER
7EEA DD7E04             00660         LD      A,(IX+4)
7EED DDBE03             00670         CP      (IX+3)  ;COMPARE
7EF0 2004               00680         JR      NZ,CRLF1
7EF2 DD360400           00690         LD      (IX+4),0
7EF6 DD7E05             00700 CRLF1   LD      A,(IX+5) ;SET CHAR COUNT
7EF9 32FE7F             00710         LD      (CHCNT),A
7EFC 3E08               00720         LD      A,8     ;DO A CARRIAGE RETURN
7EFE CD687F             00730         CALL    PRINT
7F01 3E02               00740 LF      LD      A,2     ;DO A LINE FEED
7F03 CD687F             00750         CALL    PRINT
7F06 CD927F             00760         CALL    DELAY   ;DELAY ABOUT  125 SEC FOR
                        00770                         ;MECHANICAL SETTLE OF TTY
7F09 C9                 00780         RET
                        00790
7F0A E67F               00800 ALPHA   AND     7FH     ;GET RID OF MSB
7F0C FE60               00810         CP      96D     ;CHECK FOR LOWER CASE
7F0E 3802               00820         JR      C,ALPH1
7F10 D620               00830         SUB     32D     ;ADJUST TO UPPER CASE
7F12 D621               00840 ALPH1   SUB     33D     ;ADJUST TO TABLE
7F14 21A67F             00850         LD      HL,TABLE
7F17 85                 00860         ADD     A,L
7F18 6F                 00870         LD      L,A
7F19 7E                 00880         LD      A,(HL)  ;GET TABLE ENTRY
7F1A FE80               00890         CP      80H     ;IF BIT 8 SET GET SPECIAL TREATMENT
7F1C 302D               00900         JR      NC,SPEC
                        00910
7F1E FE20               00920 CHOUT   CP      20H     ;CHECK FOR LETTER
7F20 F5                 00930         PUSH    AF      ;SAVE COPY
7F21 21FB7F             00940         LD      HL,SHFT ;CHECK FOR SHIFT
7F24 7E                 00950         LD      A,(HL)
7F25 300D               00960         JR      NC,FIG
7F27 FEFF               00970         CP      0FFH    ;IT'S A LETTER, SEE IF ALREADY SHIFTED
7F29 2814               00980         JR      Z,CONT  ;IF YES JUMP AHEAD
7F2B 36FF               00990         LD      (HL),0FFH ;SET SHFT = 0FFH
7F2D 3E1F               01000         LD      A,1FH   ;DO A LETTER SHIFT
7F2F CD687F             01010         CALL    PRINT
7F32 1808               01020         JR      CONT
7F34 FE00               01030 FIG     CP      00      ;IT'S A FIGURE, SEE IF ALREADY SHIFTED
7F36 2807               01040         JR      Z,CONT  ;IF YES JUMP AHEAD
7F38 3600               01050         LD      (HL),00 ;IF NOT, SET SHFT = 00
7F3A 3E1B               01060         LD      A,1BH   ;DO A FIGURE SHIFT
7F3C CD687F             01070         CALL    PRINT
7F3F 21FE7F             01080 CONT    LD      HL,CHCNT ;POINT AT CHAR COUNTER
7F42 35                 01090         DEC     (HL)    ;DECREMENT SAME
7F43 2003               01100         JR      NZ,CONT1 ;IF ZERO DO A CARRIAGE RETURN
7F45 CDE77E             01110         CALL    CRLF    ; AND LINE FEED
7F48 F1                 01120 CONT1   POP     AF      ;PRINT CHARACTER
7F49 181D               01130         JR      PRINT
                        01140
7F4B E67F               01150 SPEC    AND     7FH     ;GET RID OF MSB
7F4D F5                 01160         PUSH    AF      ;SAVE A COPY
7F4E 3E3C               01170         LD      A,3CH   ;PRINT A '<'
7F50 CD1E7F             01180         CALL    CHOUT
7F53 21E57F             01190         LD      HL,SPTB ;GET CHAR. FROM SPECIAL TABLE
7F56 F1                 01200         POP     AF
7F57 85                 01210         ADD     A,L
7F58 6F                 01220         LD      L,A
7F59 E5                 01230         PUSH    HL      ;SAVE POINTER
7F5A 7E                 01240         LD      A,(HL)  ;PRINT FIRST CHARACTER
7F5B CD1E7F             01250         CALL    CHOUT
7F5E E1                 01260         POP     HL      ;GET POINTER
7F5F 23                 01270         INC     HL
7F60 7E                 01280         LD      A,(HL)  ;PRINT SECOND CHARACTER
7F61 CD1E7F             01290         CALL    CHOUT
7F64 3E3C               01300         LD      A,3CH   ;PRINT A '<'
7F66 1886               01310         JR      CHOUT
                        01320
7F68 4F                 01330 PRINT   LD      C,A     ;SAVE COPY
7F69 1E05               01340         LD      E,5     ;SET COUNTER FOR 5 BITS
7F6B CD877F             01350         CALL    SPACE   ;OUTPUT START BIT
7F6E 79                 01360 PRINT1  LD      A,C     ;GET CHARACTER
7F6F 0F                 01370         RRCA            ;ROTATE LSB TO CARRY
7F70 4F                 01380         LD      C,A     ;SAVE REMAINS
7F71 3805               01390         JR      C,PRINT2 ;IF CARRY DO A MARK
7F73 CD827F             01400         CALL    SPACE   ;OTHERWISE DO A SPACE
7F76 1803               01410         JR      PRINT3
7F78 CD827F             01420 PRINT2  CALL    MARK
7F7B 1D                 01430 PRINT3  DEC     E       ;DECREMENT 5 BIT COUNTER
7F7C 20F0               01440         JR      NZ,PRINT1
7F7E CD8D7F             01450         CALL    STOP    ;WHEN 0 OUTPUT STOP BIT
7F81 C9                 01460         RET             ;AND RETURN
                        01470
7F82 AF                 01480 MARK    XOR     A       ;MARK IS A 0 OUT TO PORT FF
7F83 1618               01490         LD      D,27D
7F85 1809               01500         JR      BITOUT
7F87 3E01               01510 SPACE   LD      A,1     ;SPACE IS A 1 IN BIT 0 OF PORT FF
7F89 1618               01520         LD      D,27D
7F8B 1803               01530         JR      BITOUT
7F8D AF                 01540 STOP    XOR     A       ;STOP IS A 0 OUT TO PORT FF
7F8E 1626               01550         LD      D,38D
7F90 D3FF               01560 BITOUT  OUT     (0FFH),A ;TOGGLE BIT 0 OF PORT FF
7F92 0616               01570 DELAY   LD      B,22D   ;DELAY ABOUT  5 MS
7F94 3A4038             01580 DELAY1  LD      A,(3840H) ;TEST FOR BREAK KEY HIT
7F97 FE04               01590         CP      4
7F99 2806               01600         JR      Z,GOBACK
7F9B 10F7               01610         DJNZ    DELAY1
7F9D 15                 01620         DEC     D       ;DECREMENT  5 MS COUNTER
7F9E 20F2               01630         JR      NZ,DELAY
7FA0 C9                 01640         RET
7FA1 ED7BFC7F           01650 GOBACK  LD      SP,(SAVSTK) ;RESTORE ORIGINAL STACK
7FA5 C9                 01660         RET
                        01670
7FA6 2D                 01680 TABLE   DEFB    2DH     ; !
7FA7 31                 01690         DEFB    31H     ; "
7FA8 34                 01700         DEFB    34H     ; #
7FA9 29                 01710         DEFB    29H     ; $
7FAA 80                 01720         DEF8    80H     ; PERCENT (%)
7FAB 3A                 01730         DEF8    3AH     ; &
7FAC 2B                 01740         DEFB    2BH     ; '
7FAD 2F                 01750         DEF8    2FH     ; (
7FAE 32                 01760         DEF8    32H     ; )
7FAF 82                 01770         DEF8    82H     ; TIMES (*) OR ASTERISK
```

```
7FB0 84     01780          DEFB   84H     ; PLUS (+)
7FB1 2C     01790          DEFB   2CH     ; ,
7FB2 23     01800          DEFB   23H     ; -
7FB3 3C     01810          DEFB   3CH     ; .
7FB4 3D     01820          DEFB   3DH     ; /
7FB5 36     01830          DEFB   36H     ; 0
7FB6 37     01840          DEFB   37H     ; 1
7FB7 33     01850          DEFB   33H     ; 2
7FB8 21     01860          DEFB   21H     ; 3
7FB9 2A     01870          DEFB   2AH     ; 4
7FBA 30     01880          DEFB   30H     ; 5
7FBB 35     01890          DEFB   35H     ; 6
7FBC 27     01900          DEFB   27H     ; 7
7FBD 26     01910          DEFB   26H     ; 8
7FBE 38     01920          DEFB   38H     ; 9
7FBF 2E     01930          DEFB   2EH     ; :
7FC0 3E     01940          DEFB   3EH     ; ;
7FC1 86     01950          DEFB   86H     ; LESS THAN (<)
7FC2 88     01960          DEFB   88H     ; EQUALS (=)
7FC3 8A     01970          DEFB   8AH     ; GREATER THAN (>)
7FC4 39     01980          DEFB   39H     ; ?
7FC5 8C     01990          DEFB   8CH     ; AT (@) OR AMPERSAND
7FC6 03     02000          DEFB   3       ; A
7FC7 19     02010          DEFB   19H     ; B
7FC8 0E     02020          DEFB   0EH     ; C
7FC9 09     02030          DEFB   9       ; D
7FCA 01     02040          DEFB   1       ; E
7FCB 0D     02050          DEFB   0DH     ; F
7FCC 1A     02060          DEFB   1AH     ; G
7FCD 14     02070          DEFB   14H     ; H
7FCE 06     02080          DEFB   6       ; I
7FCF 0B     02090          DEFB   0BH     ; J
7FD0 0F     02100          DEFB   0FH     ; K
7FD1 12     02110          DEFB   12H     ; L
7FD2 1C     02120          DEFB   1CH     ; M
7FD3 0C     02130          DEFB   0CH     ; N
7FD4 18     02140          DEFB   18H     ; O
7FD5 16     02150          DEFB   16H     ; P
7FD6 17     02160          DEFB   17H     ; Q
7FD7 0A     02170          DEFB   0AH     ; R
7FD8 05     02180          DEFB   5       ; S
7FD9 10     02190          DEFB   10H     ; T
7FDA 07     02200          DEFB   7       ; U
7FDB 1E     02210          DEFB   1EH     ; V
7FDC 13     02220          DEFB   13H     ; W
7FDD 1D     02230          DEFB   1DH     ; X
7FDE 15     02240          DEFB   15H     ; Y
7FDF 11     02250          DEFB   11H     ; Z
7FE0 8E     02260          DEFB   8EH     ; ARROW UP
7FE1 90     02270          DEFB   90H     ; ARROW DOWN
7FE2 92     02280          DEFB   92H     ; ARROW LEFT
7FE3 94     02290          DEFB   94H     ; ARROW RIGHT
7FE4 23     02300          DEFB   23H     ; -
            02310
7FE5 16     02320 SPTB     DEFB   16H     ; PER CENT = .PT.
7FE6 10     02330          DEFB   10H
7FE7 10     02340          DEFB   10H     ; TIMES = .TM.
7FE8 1C     02350          DEFB   1CH
7FE9 16     02360          DEFB   16H     ; PLUS = .PL.
7FEA 12     02370          DEFB   12H
7FEB 12     02380          DEFB   12H     ; LESS THAN = .LT.
7FEC 10     02390          DEFB   10H
7FED 01     02400          DEFB   1       ; EQUALS = .EQ.
7FEE 17     02410          DEFB   17H
7FEF 1A     02420          DEFB   1AH     ; GREATER THAN = .GT.
7FF0 10     02430          DEFB   10H
7FF1 03     02440          DEFB   3       ; AMPERSAND = .AT.
7FF2 10     02450          DEFB   10H
7FF3 07     02460          DEFB   7       ; ARROW UP = .UP.
7FF4 16     02470          DEFB   16H
7FF5 09     02480          DEFB   9       ; ARROW DOWN = .DN.
7FF6 0C     02490          DEFB   0CH
7FF7 12     02500          DEFB   12H     ; ARROW LEFT = .LE.
7FF8 01     02510          DEFB   1
7FF9 0A     02520          DEFB   0AH     ; ARROW RIGHT = .RI.
7FFA 06     02530          DEFB   6
            02540
0001        02550 SHFT     DEFS   1       ;CONTAINS LAST SHIFT STATUS
            02560                         ; IF 00 THEN ALREADY FIG SHIFTED
            02570                         ; IF FF THEN ALREADY LET SHIFTED
            02580
0002        02590 SAVSTK   DEFS   2       ;STORAGE FOR CALLING ROUTINE
            02600                         ;STACK POINTER
            02610
7FFE 48     02620 CHCNT    DEFB   72D     ;CURRENT CHARACTER POSITION ON
            02630                         ;LINE BEING PRINTED
7E9A        02640          END    7E9AH
00000 TOTAL ERRORS
GOBACK  7FA1
DELAY1  7F94
BITOUT  7F90
STOP    7F8D
MARK    7F82
PRINT3  7F7B
PRINT2  7F78
PRINT1  7F6E
SPACE   7F87
SPTB    7FE5
CONT1   7F48
CONT    7F3F
FIG     7F34
SHFT    7FFB
CHOUT   7F1E
SPEC    7F4B
TABLE   7FA6
ALPH1   7F12
DELAY   7F92
CHCNT   7FFE
CRLF1   7EF6
VT1     7EDB
PRINT   7F68
SPCHR   7ECA
FRMFD   7ECF
VERTAB  7ED4
LF      7F01
CRLF    7EE7
ALPHA   7F0A
SAVSTK  7FFC
LPRT    7EA8
LOAD    7E9A
```

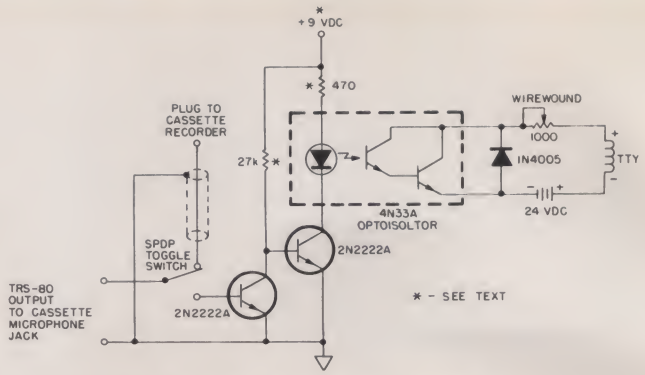


Fig. 4. Alternative interface.

sive, but Poly Paks, PO Box 942, South Lynnfield MA 01940, offers a Wabash 5504-11011 mercury-wetted relay that should do the trick for $2.50. The specifications for this relay from Wabash show the nominal coil voltage to be 15 volts dc with a maximum of .30 volts dc and a must-operate of 6.4 volts dc.

All this means that the relay should operate reliably at 9 volts dc (a single 9 volt battery), but if not then 18 volts dc (two batteries in series) will not damage the coil. I have used a similar relay and a single battery for several months with no problems (remember, the battery is used only when outputting space bits to the TTY).

Fig. 4 shows one other possibility for an electrical interface. This design is attractive in that no relay is required. The supply voltage for this design should not exceed 30 volts dc due to the electrical specifications of the 4N33 opto-isolator.

One possible substitution for the 9 volt battery would be to steal some current from the 5 volt supply available at pin 1 of the video jack of the TRS-80. The maximum current available from this source is specified at 50 mA, and only 10 mA is needed for the TTY interface LED.

Since I do not use the TRS-80 monitor I can only guess at the current required by its opto-isolator; usually optos are designed to operate reliably with 10 to 30 mA through the LED. This would leave at least 20 mA for other purposes such as the TTY interface. If a 5 volt supply is used, the resistance values will have to be reduced accordingly.

Before going any further, let me say that it is not the purpose of this article to rehash the theory and operation of teleprinters or to explain in detail the operation of software-generated UARTs. For explanations of these functions I suggest reading "Baudot Interface Cookbook" (*Kilobaud* No. 21, p. 66) and "Kilobaud Klassroom" (*Kilobaud* No. 22, p. 46).

Software

The software listing in Fig. 5 was edited and assembled using the Radio Shack Assembler Editor, which I highly recommend. This assembler is better than many commercial assemblers that cost hundreds of dollars. Following the flowcharts in Figs. 6 to 10 is the best way to understand the software driver; so study these before going on to Fig. 5.

When you enter the main rou-

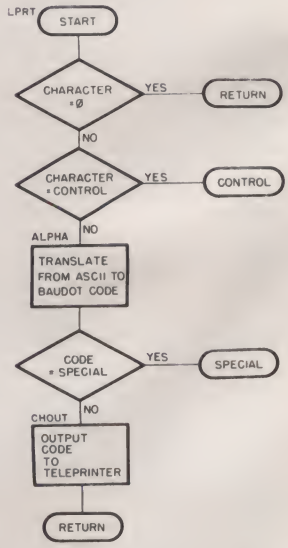


Fig. 6. Fundamental flowchart.

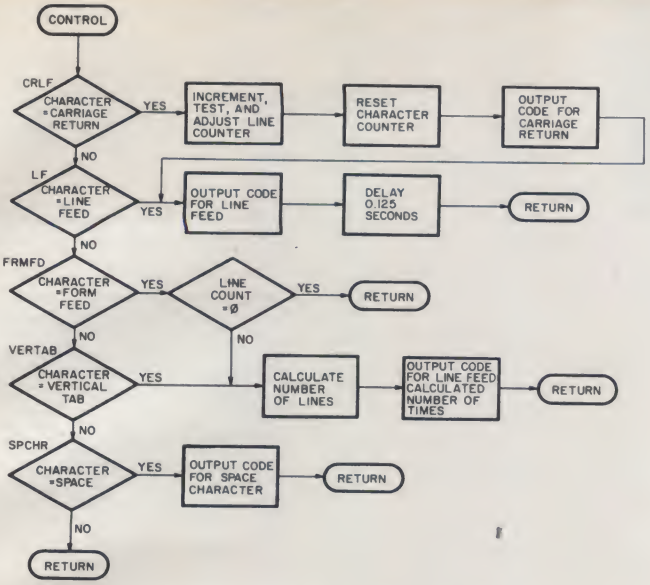


Fig. 7. Flowchart for control characters.

tine, the value of the ASCII character to be printed is checked for possible control code values. Generally all ASCII control codes have values less than 32 decimal, of which only four are of any meaning to this routine: ten for line feed, 11 for vertical tab, 12 for form feed and 13 for carriage return. These are the same codes that are discerned by the line printer routine in ROM.

In addition to the four control codes mentioned, I have also defined the space character as control. For Baudot machines a space can occur regardless of the mechanical shift position of the carriage. It is more effective, therefore, to define it this way and not require the shifting or unshifting every time a space is required. All of these codes are used as shown in Fig. 7 and are primarily for positioning the paper for the next printed character.

If the character is not used for control then it represents a printable character. Since 5-level-coded teleprinters don't print all of the characters that are represented by the ASCII character set, any character to be printed must be checked to see if special action must be taken.

All character codes that are not control are referenced in the table of Fig. 5 called TABLE (unique name). The first entry in TABLE is the Baudot code for !, which corresponds to ASCII 33. The second entry is for ", which corresponds to ASCII 34. The third entry is for #, which corresponds to ASCII 35.

This pattern is followed for the entire ASCII set of characters, except lowercase alphabetics. Those characters not found on Baudot teleprinters are marked for special treatment in TABLE. This mark is setting bit 7 of the TABLE entry equal to one for special and equal to zero for normal treatment. With this coding it is easy to determine if a character must be translated to two letters or not.

Fig. 8. Flowchart for characters needing translation.

Eleven ASCII characters—; % * + < > @ ↑ ↓ ← →—are not printable on the typical Baudot teleprinter. These characters are specially translated by the SPEC routine into a sequence of characters. The % character, for example, is printed as .PT. All of these two-letter sequences are defined in a table called SPTAB in Fig. 5 and are referenced in the SPEC routine, flowcharted in Fig. 8.

Once a character code is ready to be printed on the TTY, the CHOUT routine (Fig. 9), which maintains the shift status of the teleprinter is called.

Before a letter or a figure character is to be printed, the mechanical shift position of the TTY must be adjusted if not already in the proper position. The current shift position is determined by checking the SHFT byte in memory. SHFT is set or reset every time a letter or figure shift is sent to the TTY.

If a character requires a figure-shifted carriage position, then its TABLE value will have bit 5 equal to one; otherwise, this bit will be zero. Therefore, by checking bit 5 of the character to be printed and also checking the SHFT byte, it is a relatively easy task to maintain the proper mechanical shift of the TTY. After checking and adjusting (if needed) the shift position, the PRINT routine is called.

The PRINT routine is the software UART that "serializes" the Baudot character to the TTY. The technique used has been discussed in several articles in the hobby arena. Fig. 10 represents a flowchart of the routine. Within the PRINT routine is a software delay that determines the speed of the TTY output. The delay is set by the constant value at location 7F93H or 32659D. For 100 wpm (words per minute) the value is 22 decimal. For other speeds the value must be changed. For 60 wpm try 37D; for 75 wpm try 29D.

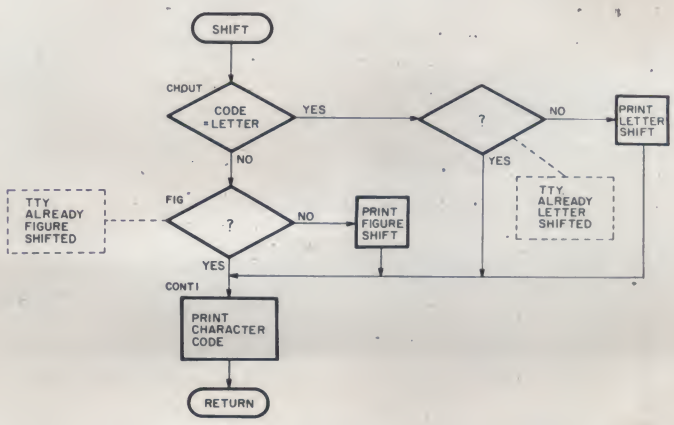


Fig. 9. Flowchart for maintaining shift position.

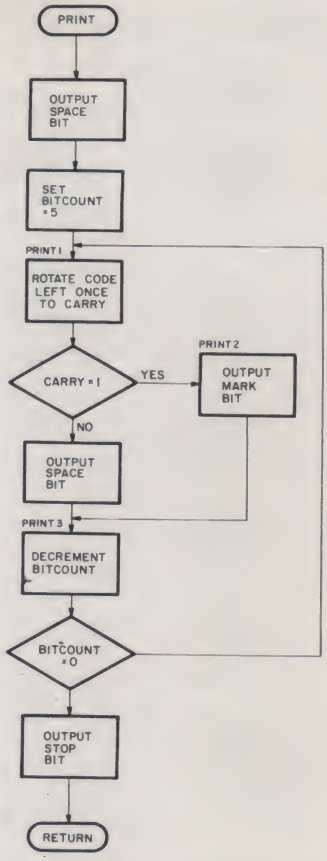


Fig. 10. Flowchart for software UART.

Interface Operation

First, assemble the interface from the schematic in Fig. 3 or 4. Check out the interface using the following routine from BASIC: 100 OUT255,1: GOTO 100. The routine will operate the relay of Fig. 3 and therefore open the current loop. If the relay does not operate, check out your wiring, then try substituting other transistors; it's possible that individual transistors may not have enough gain (if possible, choose the transistor with the lowest base-to-emitter-voltage drop with constant current input).

Second, create a tape that can be loaded by the SYSTEM command. The tape can be made using the Radio Shack T-BUG monitor and the M command. With T-BUG, modify the memory locations as shown in the software listing, check your work again using the M command and then save the result using the P command. The starting address is 7E9AH, the ending address is 7FFFH and the entry address is 7E9AH. Give the routine an appropriate name (such as TTY). The preceding method, although tedious, is entirely adequate.

Another method that can be used to create the tape is to use the editor-assembler and type in the software as in the listing. The advantage of this method is twofold: First, the routine can be relocated in memory by redefining the ORIGIN statements (appropriate, especially if you have only 4K of RAM); second, you can easily modify the routine to perform to your demands (different translation, etc.). Third, power up your system and answer the MEMORY SIZE? prompt with 32410. Type SYSTEM and, when the prompt appears, type the name of your saved routine (my routine is called TTY).

After the routine is loaded, type / and ENTER, and you will be back in BASIC, ready to go! Your teleprinter will now perform exactly as the Radio Shack line printer does, responding to the same commands as shown in the Level II manual. In addition to what is shown in the manual, you can also set the maximum line width by poking at location 16426(402AH) a decimal value for line width (the value is initially set at 72 by the LOAD routine of the interface driver).

This interface performs equally well with the Radio Shack disk-based system. The electrical interface remains the same; the software requires one minor modification. Change the HALT instruction at the end of the LOAD routine to a JP 402DH.

I have purposely left two bytes spare after the HALT so that this instruction can be inserted from T-BUG or poked from BASIC. In order to use it with the disk system, create a /CMD file on disk (such as TTY/CMD) using the TAPEDISK or DUMP utility commands (DOS version 2.1).

Before entering BASIC, simply type TTY and ENTER; the program will be entered into RAM and the DOS READY prompt will return to the screen. Enter BASIC and answer the MEMORY SIZE? prompt with 32410. The TTY will respond as described above.

Conclusion

In this article I have presented a low-cost, reliable means to connect a Baudot teleprinter to your Level II TRS-80 system. There are no known bugs in the interface, which I have used for several months.

If you feel that you cannot duplicate the program on tape, I can provide a tape of the program as described in this article for $6. For a slightly modified program (e.g., different origin, TTY speed, minor translation change) the price is $12. Send a money order to David G. Morr, 6599 Red Fox Rd., Reynoldsburg OH 43068.

I want to acknowledge the support I've received from Messrs. Fred Hatfield and Bill Louden—Fred for extensively testing and using the interface and Bill (a Radio Shack store manager) for being a good source of information about the TRS-80 and for providing the means to produce the camera-ready software listing used in this article. ■

Reader Service—see page 179

Osborne & Associates, Inc.

The World Leaders in Microprocessor Books

Program Books Written in BASIC

Payroll with Cost Accounting	#09-8	$15.00
Accounts Payable and Accounts Receivable	#13-6	$15.00
General Ledger	#20-9	$15.00

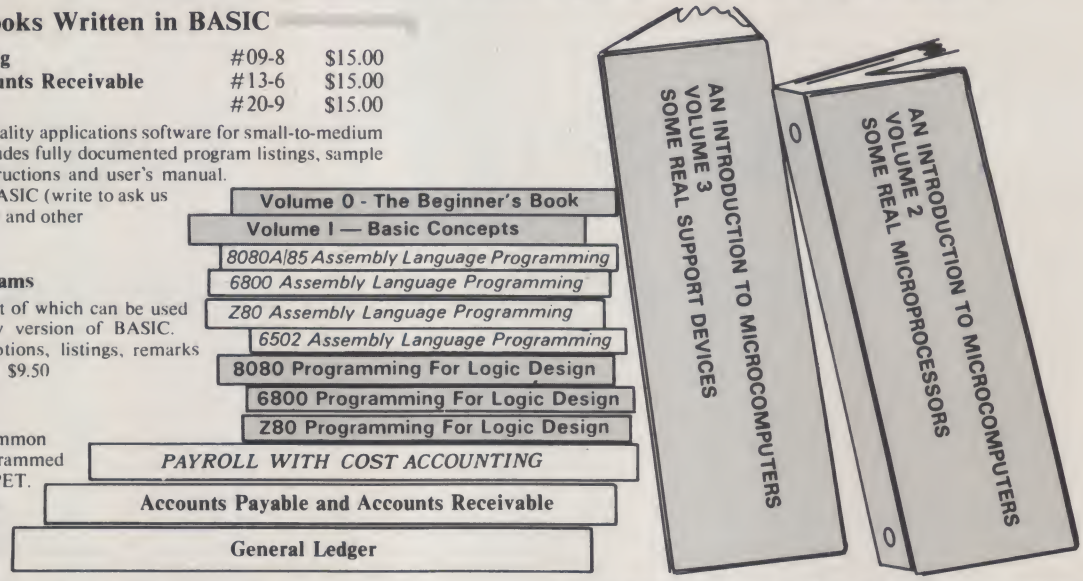
These books feature complete, quality applications software for small-to-medium sized businesses. Each book includes fully documented program listings, sample printed reports, installation instructions and user's manual. Written in an extended Wang BASIC (write to ask us about our CP/M CBASIC version and other conversions).

Some Common BASIC Programs

76 short practical programs, most of which can be used on any microcomputer with any version of BASIC. Complete with program descriptions, listings, remarks and examples. 200 pages. #06-3 $9.50

NEW PET Cassette

All 76 programs from Some Common BASIC Programs are now reprogrammed ready to run on the Commodore PET. Available on cassette only. The book is necessary for program documentation and user instructions. #25-X $10.00



Assembly Language Programming

8080A/8085 Assembly Language Programming	#10-1	$9.50
6800 Assembly Language Programming	#12-8	$9.50
NEW **Z80 Assembly Language Programming**	#21-7	$9.50
COMING **6502 Assembly Language Programming**		

These books describe how to program a microcomputer using assembly language. They discuss classical programming techniques, and contain simplified programming examples relevant to today's microcomputer applications. 400 pages each.

Programming for Logic Design

8080 Programming for Logic Design	#04-7	$9.50
6800 Programming for Logic Design	#05-5	$9.50
Z80 Programming for Logic Design	#11-X	$9.50

These books describe the meeting ground of programmers and logic designers; written for both, they provide detailed examples to illustrate effective usage of microprocessors in traditional digital applications. 300 pages each.

An Introduction to Microcomputers

Volume 0 - The Beginner's Book

If you're not familiar with computers, but would like to be, then this is the book for you. Computer logic and terminology are introduced in a language the beginner can understand. Computer software, hardware and component parts are described, and simple explanations given for how they work. Text is supplemented with creative illustrations and numerous photographs. 300 pages. #08-X $7.95

Volume 1 - Basic Concepts

A must for anyone in the computer field, this best selling text explains hardware and programming concepts common to all microprocessors. Its universal appeal is reflected by its having the greatest yearly sales volume of any computer text. 350 pages. #02-2 $9.50

Volume 2 - Some Real Microprocessors*

Provides objective, commercial-free descriptions of virtually every microprocessor on the market today. Lets you know what's available, how they work (or sometimes don't work), and how to use them. More detailed user/designer information than provided by most manufacturers.

Volume 3 - Some Real Support Devices*

Same objective, in-depth coverage as Volume 2, but applied to support devices that might be used in any microprocessor system: memory, data communication devices, data converters, direct memory access controllers, busses, and much more.

***Volume 2 and Volume 3 Updates**

To cope with the rapid evolution of microprocessor products, Volumes 2 and 3 have their own series of six bimonthly updates, allowing you to remain current with all parts as soon as they are really available. Update subscriptions sold separately.

Volume 2 1978 ed., 1400 pgs, loose leaf	#15-2	$25.00
Volume 2 binder	#16-0	$ 5.00
Volume 3 1978 ed., 700 pgs, loose leaf	#18-7	$15.00
Volume 3 binder	#19-5	$ 5.00
Volume 2 1978-1979 update only	#97	$25.00/yr.
Volume 3 1978-1979 update only	#98	$25.00/yr.
Volume 2 and 3 1978-1979 updates	#99	$40.00/yr.

OSBORNE & ASSOCIATES, INC.
630 Bancroft Way, Dept. D16 ✓06
Berkeley, CA 94710

(415) 548-2805
TWX 910-366-7277

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

PHONE _____

Book/Cassette	Price	Quantity	Amount
		Subtotal	
Calif. residents add 6% sales tax. S.F. BART residents add 6-1/2 % sales tax. No tax on update subscriptions.		California residents tax	
Updates:			
		Shipping	
		TOTAL AMOUNT ENCLOSED	

SHIPPING (Shipping for large orders to be arranged)
Vol. 2 and Vol. 3 update subscriptions:
- ☐ $4.00 foreign air mail shipping per update subscription
- ☐ No charge in the U.S. - 4th class mail ONLY

Books & Binders:
- ☐ All foreign orders $4.00 per book for airmail
- ☐ $0.45 per item 4th class in the U.S. (allow 3-4 weeks)
- ☐ $0.75 per item UPS in the U.S. (allow 10 days)
- ☐ $1.50 per item special rush shipment by air in the U.S.

Cassettes:
- ☐ No additional charge in the U.S.
- ☐ $1.50 each foreign air mail

Payment in advance must be enclosed for purchases of up to $70.00. Invoicing U.S. purchases over $70.00 available upon approval of your account. All foreign orders must be prepaid in U.S. dollars drawn on a U.S. bank.

Please send the following information:
- ☐ Becoming an O&A dealer
- ☐ School discounts
- ☐ List of foreign distributors
- ☐ Current catalog
- ☐ CP/M CBASIC business programs

S1025

✓ Reader Service—see page 179

Terry Kepner
1602 S. Avenida Sirio
Tucson AZ 85710

MURPHY'S LAWS

and other observations

Things could be worse; given enough time, they will be.

Anyone who has had any contact at all with computers—building, repairing or programming them—knows Murphy's Laws. However, many people are unaware of the many other laws, rules and observations that have also turned up since the advent of machines and, later, computers.

The following series of observations have all been chosen because of their applicability to computerdom. I hope you enjoy reading them as much as I enjoyed finding them.

Preface. We, the willing, led by the unknowing, are doing the impossible for the ungrateful. We have done so much for so long with so little, we are now qualified to do anything with nothing.

Murphy's Laws. (1) If anything can go wrong, it will. (2) If there is a possibility of several things going wrong, the one that will cause the most damage will be the first one to go wrong. (3) If anything just cannot go wrong, it will anyway. (4) If you perceive that there are four possible ways in which something can go wrong, and circumvent these, then a fifth way, unprepared for, will promptly develop. (5) Left to themselves, things tend to go from bad to worse. (6) If everything seems to be going well, you have obviously overlooked something. (7) Nature always sides with the hidden flaw. (8) Mother Nature is a bitch.

O'Toole's Commentary on Murphy's Laws. Murphy was an optimist.

Ginsberg's Theorems. (1) You can't win. (2) You can't break even. (3) You can't even quit the game.

Forsyth's Second Corollary to Murphy's Laws. Just when you see the light at the end of the tunnel, the roof caves in.

Weiler's Law. Nothing is impossible for the man who doesn't have to do it himself.

The Laws of Computer Programming. (1) Any given program, when running, is obsolete. (2) Any given program costs more and takes longer each time it is run. (3) If a program is useful, it will have to be changed. (4) If a program is useless, it will have to be documented. (5) Any given program will expand to fill all the available memory. (6) The value of a program is inversely proportional to the weight of its output. (7) Program complexity grows until it exceeds the capability of the programmer who must maintain it.

Pierce's Law. In any computer system, the machine will always misinterpret, misconstrue, misprint or not evaluate any math or subroutines or fail to print any output on at least the first run through.

Corollary to Pierce's Law. When a compiler accepts a program without error on the first run, the program will not yield the desired output.

Addition to Murphy's Laws. In nature, nothing is ever right. Therefore, if everything is going right . . . something is wrong.

Brook's Law. If at first you don't succeed, transform your data set!

Grosch's Law. Computing power increases as the square of the cost.

Golub's Laws of Computerdom. (1) Fuzzy project objectives are used to avoid embarrassment of estimating the corresponding costs. (2) A carelessly planned project takes three times longer to complete than expected; a carefully planned project takes only twice as long. (3) The effort required to correct course increases geometrically with time. (4) Project teams detest weekly progress reporting because it so vividly manifests their lack of progress.

Osborn's Law. Variables won't; constants aren't.

Gilb's Laws of Unreliability. (1) Computers are unreliable, but humans are even more unreliable. (2) Any system that depends upon human reliability is unreliable. (3) Undetectable errors are infinite in variety, in contrast to detectable errors, which by definition are limited. (4) Investment in reliability will increase until it exceeds the probable cost of errors, or until someone insists on getting some useful work done.

Lubarsky's Law of Cybernetic Entomology. There's always one more bug.

Troutman's Postulate. Profanity is the one language understood by all programmers.

Weinberg's Second Law. If builders built buildings the way programmers wrote programs, then the first woodpecker that came along would destroy civilization.

Gumperson's Law. The probability of anything happening is in inverse ratio to its desirability.

Gummidge's Law. The amount of expertise varies in inverse ratio to the number of statements understood by the general public.

Zymurgy's First Law of Evolving System Dynamics. Once you open a can of worms, the only way to recan them is to use a larger can (old worms never die, they just worm their way into larger cans).

Harvard's Law, as Applied to Computers. Under the most rigorously controlled conditions of pressure, temperature, volume, humidity and other variables, the computer will do as it damn well pleases.

Sattinger's Law. It works bet-

ter if you plug it in.

Jenkinson's Law. It won't work.

Horner's Five-Thumb Postulate. Experience varies directly with equipment ruined.

Cheops' Law. Nothing ever gets built on schedule or within budget.

Rule of Accuracy. When working toward the solution of a problem, it always helps if you know the answer.

Zymurg's Seventh Exception to Murphy's Laws. When it rains, it pours.

Pudder's Laws. (1) Anything that begins well ends badly. (2) Anything that begins badly ends worse.

Westheimer's Rule. To estimate the time it takes to do a task: Estimate the time you think it should take, multiply by two and change the unit of measure to the next highest unit. Thus, we allocate two days for a one-hour task.

Stockmayer's Theorem. If it looks easy, it's tough. If it looks tough, it's damn near impossible.

Atwood's Corollary. No books are lost by lending except those you particularly wanted to keep.

Johnson's Third Law. If you miss one issue of any magazine, it will be the issue that contains the article, story or installment you were most anxious to read.

Corollary to Johnson's Third Law. All of your friends either missed it, lost it or threw it out.

Harper's Magazine Law. You never find the article until you replace it.

Brooke's Law. Adding manpower to a late software project makes it later.

Finagle's Fourth Law. Once a job is fouled up, anything done to improve it will only make it worse.

Featherkile's Rule. Whatever you did, that's what you planned.

Flap's Law. Any inanimate object, regardless of its position, configuration or purpose, may be expected to perform at any time in a totally unexpected manner for reasons that are either entirely obscure or else completely mysterious. ■

Thoughts on the SWTP Computer System

This fourth installment reviews four cassette interfaces for the 6800—and some software.

Peter A. Stark
PO Box 209
Mt. Kisco NY 10549

This is the fourth in a series of articles on the SWTP 6800 computer system. This month we will review four cassette interfaces available for the SWTP system and some related software:

The SWTP AC-30 ($80 kit, made by Southwest Technical Products Corporation, 219 W. Rhapsody, San Antonio TX 78216).

The Percom CIS-30 + ($80 kit, $100 wired, made by Percom Data Company, Inc., 318 Barnes, Garland TX 75042).

The PCC ACI-30 ($60 wired, made by Personal Computing Company. I have been unable to find out the company's latest address, if any, but this unit may still be available through local computer stores).

The JPC TC-3 ($50 kit, JPC Products Co., PO Box 5615, Albuquerque NM 87185). For the rest of this review, I'll simply refer to them as the SWTP, Percom, PCC and JPC interfaces.

I own both the Percom and the PCC interfaces, and the JPC Products Co. was nice enough to lend me one of their interfaces for a few weeks of tests. Though I don't have the SWTP unit, I'm fairly well familiar with it.

Mechanical Details

The SWTP is a fairly large box—about 12 × 12 inches and 3 inches high—which has 17 switches, indicators and jacks on the front panel. The Percom is a smaller box—about 4 × 5 inches and 2 inches high—with three switches and an indicator on the front. The PCC is a PC board that plugs into an I/O slot inside the computer. It doesn't have any switches or indicators on the card, but one external switch and one indicator have to be mounted somewhere and connected to it; I have mounted mine on the computer's front panel. Finally, the JPC is also an I/O-size card that plugs into a slot in the motherboard, but this one has no controls at all.

Where They Fit into a System

The SWTP, PCC and Percom interfaces connect between the computer's serial interface and the control terminal. All computer output goes through the cassette interface and can be recorded on tape as well as fed to the terminal. For input, you can switch the cassette interface to accept data either from the keyboard or from the cassette. Since the cassette is on the same port as the terminal, any program that will work with the keyboard will also work with cassette.

The JPC is completely self-contained and doesn't work with a serial or parallel interface at all. Instead, it plugs directly into an I/O port on the motherboard. This makes it independent of the normal serial interface, but dependent on special software.

Power Connections

The SWTP interface has its own power supply, which has to be plugged into 110 volt power. The Percom interface receives its power through the connecting cable that goes to the computer's serial interface (a short jumper has to be added to the MP-C or MP-S card to bring + 5 volts to the I/O connector). The JPC is powered by the computer since it's plugged into an I/O slot.

The PCC interface also gets its power by being plugged into a computer I/O port. But power is the only plug-in benefit; all other connections are made through a short cable to the serial interface. If all of your ports are filled, then you can mount the PCC interface in some other way and provide separate power connections.

Recorder Connections and Motor Control

The SWTP interface has provisions for two separate cassette recorders connected at the same time. There are two sets of input and two sets of output jacks, and two switches select which recorder will record and which will read at any given time. This interface also has motor control circuits, which allow the computer to turn the motors in the two recorders on and off. In this way, a program can read data from one tape, process it and then record the changed data on a second tape. But the motor control circuits require an external pulse signal to drive them; this is normally obtained from an SWTP CT-1024 or CT-64 terminal. Without one of the SWTP terminals, you have to either build a separate control decoder or give up motor control altogether.

The Percom interface is designed for only one recorder, and so no switching is required to switch from one to the other. But its input and output plugs could be connected to two recorders, if desired. Motor control is an option, and there is space on the printed circuit board to mount the needed parts to control two recorders. The one used for playback is then controlled by the reader-control output of the MP-S or MP-C interface, so no external decoding is needed as with the SWTP interface. The second recorder would still have to be controlled by external signals, but in many applications one motor control may be enough so there is usually no need to connect to an SWTP terminal. (But from last month's discussion of MP-C and MP-S interfaces, you will remember that the reader control line may not operate just the way you want.)

The PCC and JPC interfaces are also designed for only one recorder, but their input and output audio leads can be connected to two. They have no motor control at all, but the JPC has PIA outputs that can be used for that purpose if you add an external switching circuit and use the right program.

I feel that motor control is a mixed blessing. With the motor off, inexpensive cassette recorders leave the capstan and pressure roller against the tape, causing a dent in the roller and a kink in the tape if left for a long time. This causes uneven tape speed and flutter. For

most programs, motor control is not needed. Even if it is, you have to add programming steps to provide a time delay before and after all data for the motor to come up to speed and then to stop again. Finally, motor control would be useful if the cassette recorder could also perform a rewind or fast forward operation under program control. But when you have to wind manually, you usually find that the computer wants to turn the motor off just when you need it on, and so you end up repeatedly plugging and unplugging the motor connector. In the long run, motor control is more of a pain than it's worth.

Data Formats and Baud Rates

All of the foregoing details are relatively unimportant in comparison with the data formats and baud rates that these units can operate at. Read this section carefully, since this is where the big differences are.

The SWTP is designed for 300 baud Kansas City (KC) operation. This is its primary mode, but there are two available programs that will allow operation at higher speeds. One is RADAR (RAM Dump And Restore), which will allow dumping and loading memory at 1200 baud (available from G. Trollope, 466 Caswallen Dr., West Chester PA 19380, at $20 for an object cassette and instructions). The second high-speed tape program is called WHIZ (available for $15.95 from Computerware Software Services, 830 First Street, Encinitas CA 92024). Although the SWTP will work with either an MP-C or MP-S interface at 300 baud, 1200 baud operation with RADAR is only possible with an MP-C.

The PCC interface is also designed for 300 baud Kansas City format tapes, but PCC supplies with it a memory dump and load program that works at 2400 baud if an MP-C interface is used; 300 baud can be used with both an MP-S and MP-C. (The PCC interface will also work at 1200 baud with RADAR if an MP-C interface is used; this is slower than 2400 baud, but the error correction of RADAR may make it worthwhile anyway.)

The Percom will work at 300, 600 or 1200 baud with either an MP-S or MP-C interface, but the MP-C interface causes some problems and is not really as effective. The Percom unit works with Kansas City tapes, and operation at 600 and 1200 baud is accomplished with hardware, rather than software. Thus this interface will work at these higher speeds even with unmodified programs. Although the other interfaces work at high speed with special software, the available programs are mostly for memory dumps. The Percom will also work with BASIC programs and data files and assembler source and object code.

The JPC unit is in a class by itself. It occupies a separate port and contains a minimum amount of hardware. The recording format is determined by the program. JPC supplies dump and load programs for 300 baud KC format, as well as 4800 baud operation. (You read it right—4800 baud!)

Now that we have a rough idea of how these four are related, let's look at them one by one.

The SWTP AC-30

With all its switches and indicators, the SWTP interface is the most impressive. (But because of all the switches, etc., it is also the hardest to build.) It is the only interface that connects to two recorders at the same time and allows switching of inputs and outputs without plugging and unplugging cables. It also provides adequate motor control (if used with an SWTP terminal). It was specifically designed for the KC tape format and does a nice job at it.

As originally designed, the SWTP unit was intended only for 300 baud. You are restricted to this rate if you are using it with an MP-S serial interface. However, if you are still using your MP-C control interface on port 1, then the RADAR program mentioned above will let you run at 1200 baud. The program works by removing some of the redundancy present in the KC tape format.

The program uses two cycles of 2400 Hz or one cycle of 1200 Hz for the binary 1 and 0 (instead of the eight and four cycles used by the normal KC standard). In this way, it packs four bits into the same time it normally holds only one bit. The program also compacts data into a shorter format than MIKBUG or SWTBUG, and so overall it works about nine times faster.

RADAR is unique in that it is one of the few small computer products that uses error correction. By providing a parity bit for each byte, and also a parity byte for each group of 64 bytes, RADAR has two different ways of detecting an error on the tape. If a single error occurs in the data, the two parity methods provide a cross-check against each other, and the loader program can determine which bit was wrong and fix it.

This does reduce the effective speed a bit, but it avoids the necessity of restarting the tape when an error occurs. All of the higher-speed tape methods described here require good tape recorders and quality tape, but at least RADAR will compensate for an occasional error.

The disadvantage of RADAR, as well as all other software speedup techniques, is that it requires special dump and load programs. This means that in order to load a high-speed tape you must first load in the high-speed loader (unless you put it into EPROM). This lengthens the total loading time by another 15 seconds or so.

The PCC ACI-33

In use, this interface stays out of sight—plugged into the I/O bus for power. It has two components which have to be mounted on the front panel or somewhere they are accessible. One is an LED, which indicates whether tape data is being received, and the second is a three-position switch. (Neither of these, by the way, is supplied.)

The switch has three positions—KEYBOARD, AUTO and TAPE—and is used to switch the serial input to the computer to either keyboard or tape. In the AUTO position, switching is done by the reader control line from the MP-C interface. (As mentioned last month, the MP-C reader control line works properly, but the MP-S reader control line is not handled right by SWTBUG and so no automatic switching occurs.) When you use the MP-C, the switch can be left in the AUTO position when you load programs with SWTBUG.

I recommend operating with an MP-C, since that allows you to dump and load programs at 2400 baud. Until you've been able to load BASIC in 50 seconds or so, you won't appreciate just how fast this is. (If you put the loader program into an EPROM, that time shrinks down to something like 35 seconds.)

Although the 2400 baud dump/load program is not supplied on cassette, there is a full assembly listing in the instruction manual. Hence it is easy to put this routine into a 2716 EPROM right on the CPU board. Otherwise, you must either read in the loader separately or put it at the start of each 2400 baud tape. As PCC supplies it, the dump/load program has the option of automatically putting the load/bootstrap program at the start of the tape, so that loading a 2400 baud tape is convenient.

Operation at 2400 baud is fairly reliable once you properly set up the components, but a good quality tape recorder and good tape are necessary. (I use Superscope C-103A recorder and Maxell LNC-46 tape. At about $1.25 each, this high-quality tape is a superb value.) Operation at 300 baud is excellent, and the PCC is able to read even low-quality tapes.

The Percom CIS-30+

This interface is an outboard box which connects to an MP-C or MP-S interface through a short cable. The Percom is a unique unit in that it achieves its high speed of up to 1200 baud strictly by hardware. No special programs are used, and

to the computer it looks exactly like a 300-baud interface.

The front of the Percom has three switches and one LED, which is used to indicate when tape data is being received. The left-most switch controls the speeds of either 300, 600 or 1200 baud. In use, the computer's serial interface is permanently wired for 1200 baud; this baud rate clock is sent to the Percom through the connecting cable and changed to 600 or 300 baud in the Percom by dividing it by 2 or 4. The selected baud rate clock is then used for tape data and also sent back to the ACIA or PIA on the serial interface. Thus the speed change is accomplished without having to change jumpers on the serial board.

There is one problem with this approach: The baud rate clock coming from the SWTP motherboard is insufficiently buffered; by the time it arrives at the Percom it can become distorted and noisy unless you use a short cable. In my system I used about four feet of twisted multi-conductor cable and found it necessary to install a 7404 buffer on my MP-S card to feed the clock line. Others have used shielded cable in this case. (This must be a problem with the SWTP interface as well, but perhaps the SWTP circuitry is more tolerant of bad clock signals.)

The center switch is labeled LINE and LOCAL. In the LINE position, the terminal input is connected to the output of the computer's serial interface and copies computer output. In the LOCAL position, it is fed directly by the tape. This is useful in monitoring tape signals when the CPU does not echo.

The right-hand switch is labeled AUTO and ON. In the ON position, computer input is taken from tape rather than from the keyboard. In the AUTO position, input comes either from the keyboard or from tape, as selected by the reader control line from the serial interface. (But note: The best way to use a Percom is with an MP-S interface, and, as mentioned last month, the MP-S does not provide reader control signals in normal operation. Hence the AUTO position will usually be keyboard input, with no switching done.)

At 300 baud, the Percom interface uses the standard KC format—eight cycles of 2400 Hz for a one and four cycles at 1200 Hz for a zero. At 600 baud only half that many cycles are used, and at 1200 baud only two cycles of 2400 Hz or one cycle of 1200 Hz is used.

To recover the clock from the tape, the Percom uses a phase locked loop (PLL). This allows operation at 1200 baud but causes some problems in reading tapes made with an MP-C interface. In the SWTP or PCC interfaces, clock regeneration is done by flip-flops and one-shots. If there is a gross change in tape speed, or if the characters on the tape are irregularly spaced, the clock may temporarily stop, only to restart a fraction of a clock time later. Hence the clock may be irregular, but since the computer's serial interface is tied to the clock, this causes no harm.

In the Percom, the clock regeneration is handled by a PLL, which will continue to run even in the absence of synchronizing data from the tape. If the sync data from the tape is irregular, this will cause the PLL to fall out of step and either gain or lose a few clock pulses before locking back on. This will cause errors. Moreover, at the start of data, the PLL needs a character or two to lock on before valid data starts arriving.

This problem comes up when reading tapes made with an MP-C interface. This is due to the irregular length of the stop bit at the end of a character, causing unevenly spaced characters. This is a fairly serious problem at 300 baud, but it becomes extremely noticeable at 1200 baud. Percom suggests some software patches to improve the output of the MP-C interface, but I think the only real solution is to use the Percom tape interface only with an MP-S.

Even then, the problem can come up if data was recorded at less than maximum speed. I mentioned this in Part 2 of this

✓ Reader Service—see page 179

series when I discussed the fastypist tape format; I have not been able to read some fastypist tapes with my Percom.

The only other disadvantage of the Percom is that it will only work with EIA RS-232C terminals, not with current loop terminals.

But despite these problems, the Percom has one big advantage: It requires no special software. It can be used anywhere that a 300-baud interface will work, plus it will run four times as fast. Hence you can use it for SWTBUG/MIKBUG format loads and dumps, for loading BASIC source programs, for maintaining BASIC data files, for loading Cores source and object programs or for handling text files with the TSC Text Editor. All at 1200 baud, of course.

If you buy the Percom interface, spend a few dollars for a set of the technical memos that Percom puts out for it. They are interesting reading and give additional information, not only on the interface, but on other things as well.

Reliability with my Superscope recorder and Maxell tapes has been excellent at 1200 baud . . as good as 300 baud. 1200 baud tapes are also somewhat easier than 2400 or 4800 baud tapes to interchange between systems.

The JPC TC-3

As I mentioned before, the JPC unit is completely different. Its hardware, consisting of a PIA, one operational amplifier and some inverters, is simple. Two bits from port A of the PIA are used for tape input and output. Port B is not used for tape, and so ten inverters are provided for full buffering to provide a complete parallel output port with handshaking. This port can be used for motor control, driving a printer or any other purpose.

The conversion from digital data to audio for the tape is handled strictly by software. JPC supplies programs for both standard 300 baud KC operation, as well as dumping and loading memory at 4800 baud. Except for the fact that an audio recorder is used, operation at 4800 baud is really digital in nature. Bits are recorded as pulses.

In their literature, JPC presents an interesting argument. They point out that the KC format was designed for interchange of programs from machine to machine, not for use as primary storage. Their 4800 baud system, on the other hand, is intended for primary storage and not for interchange.

Not that interchange is not possible. JPC loaned me a unit complete with a Radio Shack SCT-12 stereo cassette deck (which costs about $80), which had been adapted for motor control. But I had no trouble reading their tapes on my Superscope recorder.

However, CPU speed is a factor that does affect the baud rate since timing is done by software. Since the new SWTP MP-A2 CPU board has an RC circuit controlling CPU clock speed, there is a large variation of clock speeds among systems. JPC recommends a simple program, whose running time can be used to measure CPU speed. Several constants are then changed in the software to adjust it to the exact baud rate.

In addition to the 300 baud and 4800 baud load and dump programs that JPC provides, they have other software available as well. One program is a cassette file manager called CFM/3 (selling for about $20). It provides for saving named files on cassette and loading and/or running them. It also provides automatic motor control and has several other commands useful in debugging programs. Here are some of its commands and functions:

SAVE is used for saving a program or data file from memory to tape. For example, the command

```
SAVE,BASIC,0100,1DB0,0100
```

would save the contents of locations 0100 through 1DB0 to tape, assign it the name BASIC and give it a starting address of 0100.

LOAD gets files back from tape. The above BASIC file

✓ Reader Service—see page 179

would be loaded back with

```
LOAD,BASIC
```

The JPC provides motor control, but obviously only for starting and stopping. Hence it would be up to the user to rewind the tape to a point before the file. As the tape is read, looking for the file, CFM/3 prints out the names of other files it passes.

The LOAD command can also load files into memory locations different from where they originated and will read the next file on the tape if no name is given.

RUN allows a file to be loaded and then immediately executed. An example would be RUN,BASIC.

DIR lists the title blocks of all files on the tape.

LIST is used to give a hexadecimal dump of memory contents.

ASCI is similar to LIST but prints memory contents in ASCII.

GOTO, followed by an address, executes a jump to a program.

MON returns to monitor.

POKE is used to enter data into memory from the keyboard without returning to the monitor to do it.

MOVE is used to copy memory contents from one place to another. For instance, the command

```
MOVE,0100,1DB0,6100
```

would copy the contents of location 0100 though 1DB0 into locations 6100 through 7DB0.

FIND searches memory for a specified byte. It does the same thing as the F command in SWTBUG, but in a much more convenient way.

Another program available from JPC is a set of patches to SWTP 8K BASIC to allow saving programs at 4800 baud. The patched BASIC (a shade under 8K long) then interfaces to CFM3 (2K) to provide for saving and loading BASIC programs on 4800 baud tape. It has the following commands:

SAVE,name saves a BASIC program on tape and gives it a name.

LOAD,name loads a program back from tape, passing all programs on the tape until it reaches the one with the proper name. If no name is specified, the next program on the tape will be loaded.

DIRECT lists the directory of files on the tape.

As you can see, JPC has tried to make their 4800 baud tape system behave like a disk. Although it is not as fast as a mini disk, it is still fast enough to impress those of us who are used to 300 baud KC tapes. At 4800 baud, it loads about 480 bytes per second; this works out to 2 seconds per K, so an 8K BASIC interpreter will load in 16 seconds.

The CFM/3 Cassette File Manager is convenient and certainly takes much of the drudgery out of keeping a file of programs on tape. At 300 baud, I store just one program per cassette to avoid having to search for programs, but at 4800 baud the time required to go through a tape to search for the right one is not unreasonable.

The JPC has one disadvantage: Although it can read and write either 300 baud KC tapes or 4800 baud tapes, it needs a special program to do it. How do you load that? For this there are only three solutions: Put it in an EPROM, key it in by hand or use another tape interface to read it in from a 300 baud tape. For this reason you really need either an EPROM with the JPC programs in it (they are working on it) or another cassette interface. (Read on.)

But if you need a parallel output port—to run a printer, for instance—then the JPC gives you that port at no extra charge. Or maybe we can look at it the other way: The JPC gives you the parallel port for roughly the same price as an MP-LA parallel interface and then gives you the 4800 baud interface at no charge.

Either way, it is a fascinating product from a company new to the 6800 scene.

A Simple KC Read-Only Interface

If you don't have a standard KC tape interface—either because your system is disk oriented or because you have the JPC interface or because you just can't justify the cost—then perhaps you'll be interested in the interface in Fig. 1. You can build it for less than $5.

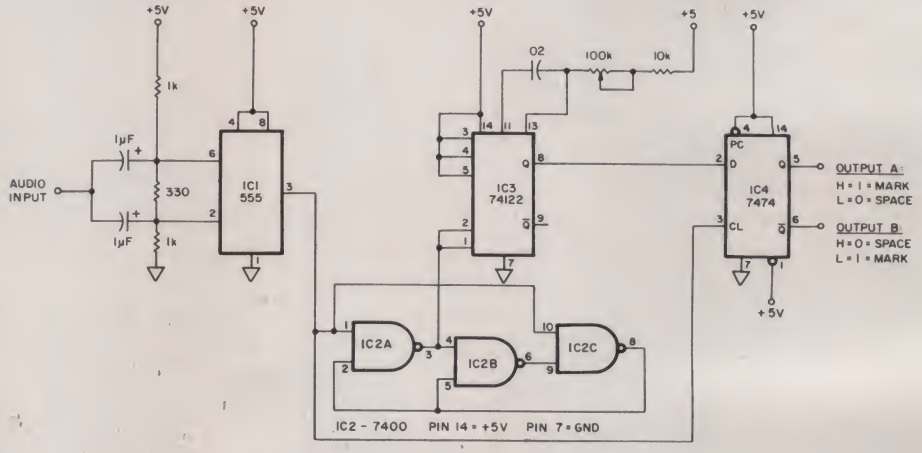


Fig. 1. A simple Kansas City tape interface (read only).

This is a read-only interface that takes several shortcuts to keep the price low. The major shortcut is the lack of clock-regeneration circuitry that all the good ones have.

The one big feature of the KC tape standard is that it is self-clocking. That is, the data is recorded on the tape in such a way that a fairly simple circuit in the read interface can recover the clock back out of it. This clock signal is then used by the computer in reading the data.

What this means is that if the tape speed is too high or too low, the recovered clock frequency will also be too high or too low. But it will be at the right speed in relation to the data, so that the computer will still be able to read the data correctly. If this weren't done, the computer would have to use its own internal clock, and so the data would be out of step with the clock. This would lead to errors.

But the presence of this clock-regenerating circuitry complicates the circuit, since we now have to do more work to process the tape signal and also have to provide switching between the tape clock and internal computer clock. Since its main purpose is to compensate for speed differences in cassette recorders, we can make do without it if we are sure that the speed is just right. We can do this by using the same recorder, both to initially record the tape and also to later read it back, and making sure that it has equally fresh batteries both times (or, better yet, running it from the ac power line at all times).

The circuit of Fig. 1 does just that—it recovers the data but not the clock. If the tape speed is correct, it will work well.

Let's look at the diagram to see how it works. The signal from the recorder is sent to two pins on a 555 timer. This is an unusual use for the 555, which acts as a comparator and amplifier in this circuit, but also provides hysteresis like a Schmitt trigger. Its purpose is

to provide a square-wave output from the tape signal at either 2400 or 1200 Hz, regardless of the distortion that may be present on the tape. It differs from a conventional Schmitt trigger IC such as a 7414 because changing the value of the 330 Ohm resistor allows us to change the triggering voltages and gain. In this case it provides better control.

The output of the 555 is a square wave that is sent both to the clock input of a 7474 type D flip-flop and to a strange circuit consisting of three NAND gates in a 7400. This circuit provides a narrow negative-going pulse whenever its input goes positive. It is like a differentiator, but I am using it because it is not much more expensive than the resistor and capacitor you'd need otherwise, and it works without loading down the output of the 555.

This negative pulse is sent to a 74122 retriggerable multivibrator—a circuit that provides a positive output pulse every time it is triggered by an input. The length of the output pulse is adjusted by the RC network connected to pins 11 and 13 so that, if the frequency of the incoming pulses is 1800 pulses per second, the length of the output pulses is such that each pulse ends just as the next one begins—in other words, the output is continuously high.

The result of this is that if the input frequency is less than 1800 Hz—1200 Hz, for instance—the output of the 74122 will have plenty of time to drop back to a low before the next pulse arrives, while if the frequency is higher than 1800 Hz—2400 Hz, for instance—the output will stay high all the time.

Every time the 555 timer provides an output pulse, the 7474 type D flip-flop is triggered via its clock line. If the output of IC3 is low at that point, indicating that the input frequency is 1200 Hz, the flip-flop will reset. But if the output of IC3 is high, indicating an input of 2400 Hz, the flip-flop will set.

Since 1200 Hz on the tape stands for a digital 0 and 2400 Hz for a digital 1, the flip-flop sets for a 1 and resets for a 0. Its output is then the digital data.

We can take the output from either output of IC4, depending on the polarity we need. For instance, the $\overline{Q}$ output of pin 6 can be connected directly to the EIA RS-232C input of either an MP-C or MP-S interface. Then all we have to do is add some switching to select between tape or keyboard.

Next Month

Have you wanted to PROM your BASIC? We'll show how next month.■

✓ Reader Service—see page 179

Terry Perdue
1470 Wilson Rd.
St. Joseph MI 49085

MUSKBD

MUSKBD is an easily implemented super music program for the SWTP 6800 system.

The program to be described is a much expanded version of the Micro Maestro program I wrote for the Motorola "D2" trainer in the January 1978 issue of *Kilobaud* ("Micro Maestro," p. 94). Despite the simplicity of that program, it generated considerable interest, giving me the incentive to write the following program.

MUSKBD was written for the SWTP MP-68 computer and *CT-64 terminal*. It turns the terminal keyboard into a three-octave organ keyboard. Music played on the "organ" is synthesized by the microprocessor, which means very little is required in the way of hardware support. In fact, all that is needed is a parallel board (MP-LA), three resistors and an audio amplifier.

Although this instrument is monotonic (only one note at a time), it has some features not found on real organs. One of these is the ability to memorize the tunes that are played on it and play them back instantaneously upon request. Along with this goes an editing feature that allows wrong notes to be deleted and another that, after any entry, echoes only the last ten notes played. This lets you check yourself as you go, without having to wait through the entire sequence.

The duration of each note is determined by the size of the note, which may be whole, half, quarter, eighth or sixteenth, and by the selected tempo, of which 15 are available. The space bar is used to form "rests," which are equal in duration to the selected note size.

The harmonic structure, or formant, is also selectable from the seven combinations of fundamental plus two subharmonics. These three square waves are mixed through 10k resistors and applied to the input of an audio amplifier. Both the note size and formant are automatically stored by the program as part of the music sequence.

Once you have programmed a tune that you would like to save to impress your friends with later, another command allows the code for the tune to be saved on cassette. To play back a tune so saved, you load MUSKBD, then load the tune code using MIKBUG or equivalent and type G.

So that people unfamiliar with this program may use it without instruction, the program provides prompts wherever appropriate. Once familiar with the commands, you may turn off these prompts. Upon initial entry to the program, each of the available commands is listed, and the user is prompted for initial note size, formant and tempo.

Also listed are the unused keys. If these keys are masked with a small piece of tape, the positions of the white and black keys become readily apparent. The keys are arranged in two tiers. The lower half of the keyboard starts with the Z key (low C) and the upper half with Q (middle F). The note-codes have been chosen based on the MP-68 clock frequency to produce frequencies that are compatible with other musical instruments, thus allowing you and your computer to become a duet!

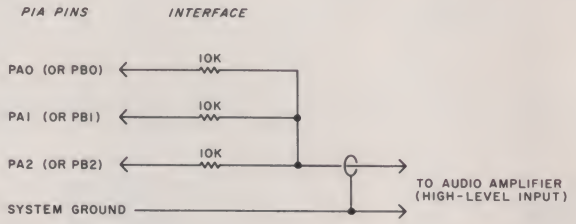


Fig. 1. Interface-to-parallel-port connections.

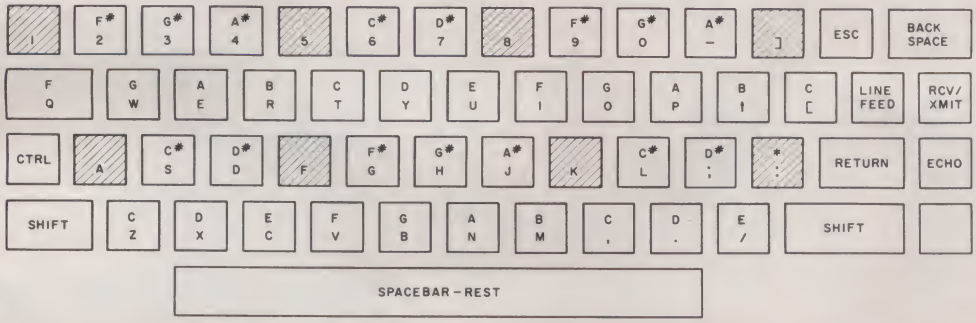


Fig. 2. Keyboard diagram shows how the CT-64 keyboard doubles as a three-octave organ keyboard.

Summary of Commands

1. To turn prompts on or off, type "*."

2. To change tempo, note size or formant, type "Return." If prompts are on, you will be asked for the parameter to be changed. After typing the specifying letter (T, S or F), the program will prompt with the available selections for that parameter, followed by what was last selected for it. If the prompts are off, only a character indicating the present value of a parameter and/or a question mark appears. This allows for faster programming, especially at lower baud rates.

The only thing that may not be obvious from the prompts is what the various characters that specify the formants stand for. F = fundamental, 1 = first subharmonic, 2 = second subharmonic, H = fundamental plus first subharmonic, L = fundamental plus second subharmonic, B = both subharmonics and A = all three.

3. To clear the tune buffer to start a new tune, type "Esc."

4. To recover from mistakes, type "Backspace." One note or "change" (size or formant) code will be deleted for each backspace typed.

5. To play the stored tune sequence, type "Line Feed." If an entry other than line feed directly precedes it, only the last ten notes entered are played back. To play the entire sequence, line feed must be typed again.

6. To store a tune sequence on tape (in coded form), type "$." A prompt tells you what to

I/O Port	'PIA' (side A)	'PIA' (side B)
0	$8000	$8002
1	—Control Port—	
2	$8008	$800A
3	$800C	$800E
4	$8010	$8012
5	$8014	$8016
6	$8018	$801A
7	$801C	$801E

Table 1. Program must reference address selected from this table (MP-68).

do and returns you to the monitor. Note that the prompt "... type 'E'" assumes your monitor to be SWTBUG. If you are using MIKBUG or some other monitor, store the program counter information in the usual way.

Adapting MUSKBD to Your System

Although written for the SWTP system, this program should be easily adaptable to other 6800-based systems and to other terminals. It has been assumed that the PIA is located at $8000. This corresponds to a parallel board at I/O slot #0 in the MP-68.

If you wish to change this address, you must change all program references to "PIA" and "PIA + 1" accordingly. If you have the −2 processor board, which uses the R-C-controlled clock chip, its frequency may need to be trimmed if compatibility with other instruments is desired. If this chip were modulated by a low-level 6 Hz sine wave, vibrato could be produced. This would add much to the fullness of the music.

If a terminal other than the CT-64 is to be used, some keys may need to be redefined. For example, a standard KSR 33 format has no backspace or "esc" keys. While control H will perform the backspace function, some other character or control character would need to be chosen for "esc" and the corresponding ASCII code substituted in the program (at $0135).

The note keys on a keyboard with KSR 33 format are in the same positions as those on the CT-64 except for the last three notes of the upper octave. These could be redefined but would probably not be missed. To allow changing note keys, I will briefly describe the note-code table.

The note-code required to produce a particular note is stored at the address corresponding to the ASCII value of the key that produces that note. For example, the Z key is used to produce low C. $76 is required to produce this frequency when counted down in the tone loop. The ASCII value of Z is $5A. Therefore, $76 is stored at address $5A.

I must add one further piece of information about the assembler directives appearing in the listing, for those who may not be familiar with them. FCB (Form Constant Byte) stores the specified byte of data at the location of the directive. If several bytes are specified, separated by commas, they are stored sequentially. FDB (Form Double Byte) does the same thing with double bytes of data. If commas are used without the data being specified, the data is assumed to be $00 or $0000.

FCC (Form Constant Character) causes the assembler to store the ASCII values of the text string that follows (between the delimiters). RMB (Reserve Memory Byte) simply tells the assembler that it should skip over the number of bytes specified, as they are to be used as temporary storage locations, or specified later. There are five bytes reserved at "Clscrn," $052A. Code that will cause your particular terminal to home-up and erase to end of page should be inserted here. The remaining bytes should be made nulls (00).

I mentioned these directives because I have used the "NOG" option of the assembler, which does not print out each byte of data to be stored at these locations in its object code field, thereby greatly reducing the length of the listing. To assist you in entering the note-code table and prompts, I have provided dumps of these in a more appropriate format.

This program is guaranteed to keep you entertained for hours (if you can keep the kids away) and may even get your wife involved! Someone who reads music should be able to easily program from sheet music, and then perhaps play accompaniment. Baroque selections should be ideal.

I would enjoy hearing your comments on this program, as well as any improvements you might come up with. The listing is well commented, so modifications should not be too difficult. Since I am not particularly musically inclined, if anyone wants to send me a cassette of code for their favorite masterpiece, I'll make a copy, return it and start a MUSKBD Music Library!

I have written a disk version of this program for the Smoke Signal Broadcasting BFD-68, which allows saving tunes as disk files. It also allows appending files (with different note sizes and formants if desired) to form longer tunes and medleys. A commented assembly listing is available by sending $4 (to cover duplication and handling) and an SASE to me. ■

Program listing.

```
00010                          NAM    MUSKBD

00030                  * WRITTEN FOR THE SWTPC MP-68 AND CT-64
00040                  * BY TERRY PERDUE  2-78

00060                          OPT    NOG,O

00080                  * EXTERNAL EQUATES

00100       E0E3   MONITR EQU    $E0E3    RESIDENT MONITOR
00110       E07E   PDATA1 EQU    $E07E    STRING OUTPUT
00120       E1AC   INEEE  EQU    $E1AC    CHAR. INPUT
00130       E1D1   OUTEEE EQU    $E1D1    CHAR. OUTPUT
00140       8000   PIA    EQU    $8000    PORT ADDRESS

00160                  * NOTE-CODE TABLE

00180 0000 0000                FDB    ,,,
00190 0008 0000                FDB    ,,,
00200 0010 0000                FDB    ,,,
00210 0018 0000                FDB    ,,,
00220 0020 7F00                FDB    $7F00,,,
00230 0028 00                  FCB    ,,,,$3B,$10,$35,$2F
00240 0030 12                  FCB    $12,,$2A,$25,$21,,$1C,$19
00250 0038 00                  FCB    ,$14,,$32,,,,
00260 0040 00                  FCB    ,,$4F,$5E,$64,$23,,$54
00270 0048 4B                  FCB    $4B,$16,$42,,$38,$3F,$46,$13
00280 0050 11                  FCB    $11,$2C,$1F,$70,$1D,$17,$59,$27
00290 0058 6A                  FCB    $6A,$1A,$76,$E,,,$F,
00300 0060 0000                FDB    ,,,
00310 0068 0000                FDB    ,,,
00320 0070 0000                FDB    ,,,
00330 0078 0000                FDB    ,,,

00360                  * MAIN PROGRAM

00380 0080 CE 0540 INIT   LDX    #BUFFER  SET POINTER
00390 0083 FF 0536        STX    NOTPTR   TO TOP OF BUFFER
00400 0086 CE 052A        LDX    #CLSCRN
00410 0089 BD E07E        JSR    PDATA1   CLEAR THE SCREEN
00420 008C CE 03D3        LDX    #INTRO
00430 008F BD E07E        JSR    PDATA1   LIST AVAIL. COMMANDS
00440 0092 BD E1AC READY  JSR    INEEE
00450 0095 81 0D          CMP A  #$D      CR TO BEGIN
00460 0097 26 F9          BNE    READY
00470 0099 BD 0176        JSR    TEMPO    SET INIT. TEMPO,
00480 009C BD 01B8        JSR    NOTLNG   NOTE SIZE,
00490 009F BD 028C        JSR    FRMANT   & FORMANT
00500 00A2 CE 052A CONTRL LDX    #CLSCRN  CLR
00510 00A5 BD E07E        JSR    PDATA1   THE SCREEN
00520 00A8 BD E1AC        JSR    INEEE    GET COMMAND OR NOTE
00530 00AB 81 03          CMP A  #3       CONTROL C TO
00540 00AD 27 2F          BEQ    EXIT     RETURN TO MONITOR
00550 00AF 81 2A          CMP A  #'*      IF *,
00560 00B1 27 26          BEQ    PYESNO   TURN PROMPTS ON/OFF
00570 00B3 81 0A          CMP A  #$A      IF LINE FEED,
00580 00B5 27 03          BEQ    PLAY     PLAY THE TUNE
00590 00B7 7E 0134        JMP    NEW
00600 00BA 4F        PLAY CLR A           STORE 0 TO BUFFER
00610 00BB BD 0326        JSR    FILL     TO ID END OF TUNE
00620 00BE 7D 0534        TST    PFLAG    IF SET,
00630 00C1 26 1E          BNE    FRMTOP   PLAY FROM THE TOP
00640 00C3 73 0534        COM    PFLAG    IF CLR, LAST 10 NOTES
00650 00C6 FE 0536        LDX    NOTPTR   FIND LAST NOTE
00660 00C9 86 0C          LDA A  #$C      READY TO COUNT BACK
00670 00CB 8C 053F TENBAC CPX    #BUFFER-1  REACHED TOP?
00680 00CE 27 11          BEQ    FRMTOP   THEN PLAY IT ALL
00690 00D0 09             DEX             BACK UP
```

```
00700 00D1 4A              DEC A          COUNT BACKUPS
00710 00D2 26 F7           BNE    TENBAC  BACK UP MORE
00720 00D4 FF 0536         STX    NOTPTR  DONE
00730 00D7 20 0E           BRA    SETFMT
00740 00D9 73 0533 PYESNO  COM    PROMPT  PROMPT ON<>OFF
00750 00DC 20 C4           BRA    CONTRL
00760 00DE 7E E0E3 EXIT    JMP    MONITR  OUT TO MONITOR
00770 00E1 CE 053F FRMTOP  LDX    #BUFFER-1  LOAD POINTER
00780 00E4 FF 0536         STX    NOTPTR  TO TOP
00790 00E7 7F 8001 SETFMT  CLR    PIA+1   SELECT
00800 00EA FE 0538         LDX    NOTFMT  HARMONIC
00810 00ED FF 8000         STX    PIA     STRUCTURE
00820 00F0 FE 0536 NUNOTE  LDX    NOTPTR  POINT TO
00830 00F3 08              INX            NEXT
00840 00F4 FF 0536         STX    NOTPTR  NOTE
00850 00F7 A6 00           LDA A  X       LOAD IT
00860 00F9 4D              TST A          IF END,
00870 00FA 27 A6           BEQ    CONTRL  RETURN
00880 00FC 85 80           BIT A  #$80    IF BIT 7 SET, CHANGE SOMETHIN
00890 00FE 27 06           BEQ    NOCHG
00900 0100 85 40           BIT A  #$40    IF BIT 6 SET,
00910 0102 27 20           BEQ    JSRFXS  CHANGE NOTE SIZE
00920 0104 20 19           BRA    JSRFXF  ELSE CHANGE FORMANT
00930 0106 81 7F   NOCHG   CMP A  #$7F    IF 7F,
00940 0108 27 1F           BEQ    REST    REST
00950 010A B7 0535         STA A  TEMP    HOLD NOTE-CODE
00960 010D FE 053B SETIME  LDX    TIMER   TIME PER NOTE
00970 0110 5C      TONLUP  INC B          TOGGLES OUTPUT WHEN STORED
00980 0111 B6 0535         LDA A  TEMP    GET NOTE-CODE
00990 0114 09      COUNT   DEX            HOLD TONE AWHILE
01000 0115 27 D0           BEQ    SETFMT  LONG ENUF?
01010 0117 4A              DEC A          COUNT DOWN
01020 0118 26 FA           BNE    COUNT   THE TONE
01030 011A F7 8000         STA B  PIA     TOGGLE OUTPUT
01040 011D 20 F1           BRA    TONLUP  TO PRODUCE TONE
01050 011F BD 0330 JSRFXF  JSR    FIXFMT  GO FIX FORMANT
01060 0122 20 C3           BRA    SETFMT  & CONTINUE
01070 0124 BD 0209 JSRFXS  JSR    FIXSIZ  GO FIX SIZE
01080 0127 20 C7           BRA    NUNOTE  & CONTINUE
01090 0129 7F 8001 REST    CLR    PIA+1   SHUT
01100 012C CE 0004         LDX    #4      OFF
01110 012F FF 8000         STX    PIA     OUTPUTS
01120 0132 20 D9           BRA    SETIME  & GO WAIT
01130 0134 81 1B   NEW     CMP A  #$1B    IF ESCAPE,
01140 0136 26 08           BNE    CHANGE
01150 0138 CE 0540         LDX    #BUFFER SET POINTER
01160 013B FF 0536         STX    NOTPTR  TO TOP OF BUFFER
01170 013E 20 33           BRA    JMPCTL  AND RETURN
01180 0140 81 0D   CHANGE  CMP A  #$D     IF CAR. RETURN,
01190 0142 27 03           BEQ    *+5
01200 0144 7E 022E         JMP    MISTAK
01210 0147 CE 052A         LDX    #CLSCRN
01220 014A BD E07E         JSR    PDATA1
01230 014D CE 04EF         LDX    #CHMENU
01240 0150 BD 02F5         JSR    PDATST
01250 0153 CE 038A         LDX    #QUEST
01260 0156 BD E07E         JSR    PDATA1
01270 0159 BD E1AC         JSR    INEEE
01280 015C 81 54           CMP A  #'T     GO CHANGE TEMPO
01290 015E 26 04           BNE    CHSIZE
01300 0160 8D 14           BSR    TEMPO
01310 0162 20 0F           BRA    JMPCTL
01320 0164 81 53   CHSIZE  CMP A  #'S     OR NOTE SIZE
01330 0166 26 04           BNE    CHFRMT
01340 0168 8D 4E           BSR    NOTLNG
01350 016A 20 07           BRA    JMPCTL
01360 016C 81 46   CHFRMT  CMP A  #'F     OR FORMANT
01370 016E 26 03           BNE    JMPCTL
01380 0170 BD 028C         JSR    FRMANT
01390 0173 7E 00A2 JMPCTL  JMP    CONTRL  THEN RETURN
01400 0176 CE 052A TEMPO   LDX    #CLSCRN
01410 0179 BD E07E         JSR    PDATA1
01420 017C CE 0336         LDX    #TMSG   CHANGE TEMPO-
01430 017F BD 02F5         JSR    PDATST  PROMPT WITH
01440 0182 CE 037A         LDX    #PRES   CHOICES
01450 0185 BD 02F5         JSR    PDATST  AND
01460 0188 B6 053D         LDA A  TASCII  PRESENT
01470 018B BD E1D1         JSR    OUTEEE  TEMPO
01480 018E CE 038A TINPUT  LDX    #QUEST
01490 0191 BD E07E         JSR    PDATA1
01500 0194 BD E1AC         JSR    INEEE   GET NEW TEMPO
01510 0197 85 F0           BIT A  #$F0    MUST BE
01520 0199 27 F3           BEQ    TINPUT  BETWEEN
01530 019B 85 B0           BIT A  #$B0    'A' AND
01540 019D 26 EF           BNE    TINPUT  'O'
01550 019F B7 053D         STA A  TASCII  SAVE ASCII TEMPO
01560 01A2 84 0F           AND A  #$F     MASK M.S. NIBBLE
01570 01A4 48              ASL A          MULT. BY
01580 01A5 48              ASL A          4
01590 01A6 B7 053B         STA A  TIMER   STORE PRODUCT
01600 01A9 B6 053A         LDA A  NOTSIZ  GET PRESENT NOTE SIZE
01610 01AC B7 0530         STA A  SIZTST  & SAVE IT
01620 01AF 86 04           LDA A  #4      MAKE IT A
01630 01B1 B7 053A         STA A  NOTSIZ  QUARTER NOTE
01640 01B4 BD 020E         JSR    CHKSIZ  GO FIX IF NECESSARY
01650 01B7 39              RTS
01660 01B8 CE 052A NOTLNG  LDX    #CLSCRN
01670 01BB BD E07E         JSR    PDATA1
01680 01BE CE 034A         LDX    #SMENU  CHANGE NOTE SIZE-
01690 01C1 BD 02F5         JSR    PDATST  PROMPT WITH
01700 01C4 CE 037A         LDX    #PRES   CHOICES
01710 01C7 BD 02F5         JSR    PDATST  AND
01720 01CA B6 053F         LDA A  SASCII  PRESENT
01730 01CD BD E1D1         JSR    OUTEEE  SIZE
01740 01D0 CE 038A SINPUT  LDX    #QUEST
01750 01D3 BD E07E         JSR    PDATA1
01760 01D6 BD E1AC         JSR    INEEE   GET NEW SIZE-
01770 01D9 16              TAB            RETAIN ASCII
01780 01DA 81 57           CMP A  #'W     IF WHOLE,
01790 01DC 26 04           BNE    HALF
01800 01DE 86 90           LDA A  #$90    LOAD CODE FOR WHOLE NOTE
01810 01E0 20 1E           BRA    NEWS    GO STORE IT
01820 01E2 81 48   HALF    CMP A  #'H     DITTO FOR OTHER NOTE SIZES
01830 01E4 26 04           BNE    QUART
01840 01E6 86 88           LDA A  #$88    NOTE THAT BIT 6 CLR WHILE
01850 01E8 20 16           BRA    NEWS    BIT 7 SET
01860 01EA 81 51   QUART   CMP A  #'Q
01870 01EC 26 04           BNE    EIGHTH
01880 01EE 86 84           LDA A  #$84    MEANS A SIZE CHANGE-
01890 01F0 20 0E           BRA    NEWS
01900 01F2 81 45   EIGHTH  CMP A  #'E
01910 01F4 26 04           BNE    SXTNTH
01920 01F6 86 82           LDA A  #$82    WHILE REMAINING BIT SET
01930 01F8 20 06           BRA    NEWS
01940 01FA 81 53   SXTNTH  CMP A  #'S
01950 01FC 26 D2           BNE    SINPUT
01960 01FE 86 81           LDA A  #$81    DETERMINES SIZE
01970 0200 F7 053F NEWS    STA B  SASCII  SAVE ASCII SIZE
01980 0203 BD 0326         JSR    FILL    STORE NEW SIZE CODE IN BUFFER
01990 0206 8D 01           BSR    FIXSIZ  & CHANGE SIZE NOW
02000 0208 39              RTS
02010 0209 84 1F   FIXSIZ  AND A  #$1F    LOOK AT SIZE-DETERMINING BITS
02020 020B B7 0530         STA A  SIZTST  SAVE FOR COMPARISON
02030 020E B6 053A CHKSIZ  LDA A  NOTSIZ  GET OLD SIZE
02040 0211 B1 0530         CMP A  SIZTST  SAME AS DESIRED?
02050 0214 27 17           BEQ    SFIXED  YES-DONE
02060 0216 0C              CLC
02070 0217 46              ROR A          NO-HALVE OLD SIZE
02080 0218 24 02           BCC    TIMADJ
02090 021A 8A 80           ORA A  #$80
02100 021C B7 053A TIMADJ  STA A  NOTSIZ
02110 021F B6 053B         LDA A  TIMER
02120 0222 0C              CLC
02130 0223 46              ROR A          AND OLD TIMER COUNT
02140 0224 24 02           BCC    RCHECK
02150 0226 8A 80           ORA A  #$80
02160 0228 B7 053B RCHECK  STA A  TIMER
02170 022B 20 E1           BRA    CHKSIZ  THEN CHECK AGAIN FOR MATCH
02180 022D 39      SFIXED  RTS
02190 022E 81 08   MISTAK  CMP A  #8      IF BACKSPACE,
02200 0230 26 12           BNE    SAVE
02210 0232 7F 0534         CLR    PFLAG
02220 0235 FE 0536         LDX    NOTPTR  & IF NOT AT
02230 0238 8C 0540         CPX    #BUFFER TOP OF BUFFER,
02240 023B 27 01           BEQ    STKBOT
02250 023D 09              DEX            DELETE LAST NOTE
02260 023E FF 0536 STKBOT  STX    NOTPTR
02270 0241 7E 00A2         JMP    CONTRL
02280 0244 81 24   SAVE    CMP A  #'$     IF 'SAVE' COMMAND,
02290 0246 26 21           BNE    STNOTE
02300 0248 CE 0536         LDX    #NOTPTR GET READY
02310 024B FF A002         STX    $A002   FOR A
02320 024E FE 0536         LDX    NOTPTR  MEMORY
02330 0251 FF A004         STX    $A004   DUMP
02340 0254 CE 00A2         LDX    #CONTRL TO
02350 0257 FF A048         STX    $A048   TAPE
02360 025A CE 052A         LDX    #CLSCRN
02370 025D BD E07E         JSR    PDATA1
02380 0260 CE 0390         LDX    #PMSG   GIVE
02390 0263 BD E07E         JSR    PDATA1  PROMPT,
02400 0266 7E E0E3         JMP    MONITR  AND EXIT
02410 0269 FE 0536 STNOTE  LDX    NOTPTR  IF THIS IS
02420 026C 8C 0540         CPX    #BUFFER FIRST NOTE,
02430 026F 26 12           BNE    JSRNIN
02440 0271 16              TAB            PRECEED IT WITH
02450 0272 B6 0538         LDA A  NOTFMT  INITIAL FORMANT
02460 0275 8A C0           ORA A  #$C0
02470 0277 BD 0326         JSR    FILL
02480 027A B6 053A         LDA A  NOTSIZ  & INITIAL NOTE SIZE
02490 027D 8A 80           ORA A  #$80
02500 027F BD 0326         JSR    FILL
02510 0282 17              TBA
02520 0283 7F 0534 JSRNIN  CLR    PFLAG   (TO PLAY ONLY 10 NOTES)
02530 0286 BD 02FE         JSR    NOTEIN
02540 0289 7E 00A2         JMP    CONTRL
02550 028C CE 052A FRMANT  LDX    #CLSCRN
02560 028F BD E07E         JSR    PDATA1
02570 0292 CE 0361         LDX    #FMENU  CHANGE FORMANT-
02580 0295 BD 02F5         JSR    PDATST  PROMPT WITH
02590 0298 CE 037A         LDX    #PRES   CHOICES
02600 029B BD 02F5         JSR    PDATST  AND
02610 029E B6 053E         LDA A  FASCII  PRESENT
02620 02A1 BD E1D1         JSR    OUTEEE  FORMANT
02630 02A4 CE 038A FINPUT  LDX    #QUEST
```

```
02640 02A7 BD E07E          JSR    PDATA1
02650 02AA BD E1AC          JSR    INEEE     GET NEW FORMANT-
02660 02AD 16               TAB               RETAIN ASCII
02670 02AE 81 46            CMP A  #'F       IF FUND.,
02680 02B0 26 04            BNE    SUB1
02690 02B2 86 C1            LDA A  #$C1      LOAD CODE FOR FUND.
02700 02B4 20 2E            BRA    NEWF      GO STORE IT
02710 02B6 81 31    SUB1    CMP A  #'1       LIKEWISE FOR OTHER FORMANTS
02720 02B8 26 04            BNE    SUB2
02730 02BA 86 C2            LDA A  #$C2      NOTE THAT BIT 6 SET WHILE
02740 02BC 20 26            BRA    NEWF
02750 02BE 81 32    SUB2    CMP A  #'2
02760 02C0 26 04            BNE    FUNONE
02770 02C2 86 C4            LDA A  #$C4      BIT 7 SET
02780 02C4 20 1E            BRA    NEWF
02790 02C6 81 48    FUNONE  CMP A  #'H
02800 02C8 26 04            BNE    FUNTWO
02810 02CA 86 C3            LDA A  #$C3      MEANS A FORMANT CHANGE-
02820 02CC 20 16            BRA    NEWF
02830 02CE 81 4C    FUNTWO  CMP A  #'L
02840 02D0 26 04            BNE    TBOTH
02850 02D2 86 C5            LDA A  #$C5      WHILE OTHER BITS SET
02860 02D4 20 0E            BRA    NEWF
02870 02D6 81 42    TBOTH   CMP A  #'B
02880 02D8 26 04            BNE    TALL
02890 02DA 86 C6            LDA A  #$C6      DETERMINE THE
02900 02DC 20 06            BRA    NEWF
02910 02DE 81 41    TALL    CMP A  #'A
02920 02E0 26 C2            BNE    FINPUT
02930 02E2 86 C7            LDA A  #$C7      HARMONIC STRUCTURE
02940 02E4 F7 053E NEWF     STA B  FASCII    SAVE ASCII FORMANT
02950 02E7 8D 3D            BSR    FILL      STORE NEW FORMANT IN BUFFER
02960 02E9 8D 45            BSR    FIXFMT    & CHANGE FORMANT NOW
02970 02EB 7F 8001          CLR    PIA+1     SET UP PIA
02980 02EE FE 0538          LDX    NOTFMT    FOR REQUIRED
02990 02F1 FF 8000          STX    PIA       HARMONICS
03000 02F4 39               RTS
03010 02F5 F6 0533 PDATST   LDA B  PROMPT
03020 02F8 26 03            BNE    RTS
03030 02FA BD E07E          JSR    PDATA1
03040 02FD 39       RTS     RTS
03050 02FE B7 0532 NOTEIN   STA A  TABLE+1
03060 0301 FE 0531          LDX    TABLE
03070 0304 A6 00            LDA A  X         GET NOTE-CODE
03080 0306 81 00            CMP A  #0        MUST BE NON-ZERO
03090 0308 27 25            BEQ    INVAL
03100 030A 81 7F            CMP A  #$7F      IF 7F, THIS IS REST
03110 030C 27 18            BEQ    FILL
03120 030E FE 053B          LDX    TIMER     ELSE PLAY THE NOTE
03130 0311 B7 0535          STA A  TEMP
03140 0314 5C       TLOOP   INC B
03150 0315 B6 0535          LDA A  TEMP
03160 0318 09       TCOUNT  DEX
03170 0319 27 08            BEQ    PREFIL
03180 031B 4A               DEC A
03190 031C 26 FA            BNE    TCOUNT
03200 031E F7 8000          STA B  PIA
03210 0321 20 F1            BRA    TLOOP
03220 0323 B6 0535 PREFIL   LDA A  TEMP
03230 0326 FE 0536 FILL     LDX    NOTPTR    STORE NOTE IN BUFFER
03240 0329 A7 00            STA A  X
03250 032B 08               INX
03260 032C FF 0536          STX    NOTPTR
03270 032F 39       INVAL   RTS
03280 0330 84 1F    FIXFMT  AND A  #$1F      LOOK AT FORMANT-DETERM. BITS
03290 0332 B7 0538          STA A  NOTFMT    & AND STORE THEM
03300 0335 39               RTS

03320               * PROMPTS

03340 0336 54       TMSG    FCC    /TEMPO: 'A' TO 'O' -/
03350 0349 04               FCB    4
03360 034A 4E       SMENU   FCC    /NOTE SIZE: W H Q E S -/
03370 0360 04               FCB    4
03380 0361 46       FMENU   FCC    /FORMANT: F 1 2 H L B A -/
03390 0379 04               FCB    4
03400 037A 0D       PRES    FCB    $D,$A,$A,,
03410 037F 50               FCC    /PRESENTLY /
03420 0389 04               FCB    4
03430 038A 0D0A     QUEST   FDB    $0D0A,$0A3F,$2004
03440 0390 54       PMSG    FCC    /TURN ON RECORDER AND TYPE 'P'./
03450 03AE 0D0A             FDB    $0D0A,
03460 03B2 57               FCC    /WHEN DUMP IS COMPLETE, TYPE 'E'./
03470 03D2 04               FCB    4
03480 03D3 2A       INTRO   FCC    /*** MUSKBD ***/
03490 03E1 0D               FCB    $D,$A,$A,,
03500 03E6 43               FCC    /COMMAND MENU:/
03510 03F3 0D               FCB    $D,$A,$A,,
03520 03F8 24               FCC    /$ = SAVE/
03530 0400 0D0A             FDB    $0D0A,
03540 0404 53               FCC    /SPACE = REST/
03550 0410 0D0A             FDB    $0D0A,
03560 0414 4C               FCC    /LINE FEED = PLAY/
03570 0424 0D0A             FDB    $0D0A,
03580 0428 2A               FCC    !* = PROMPT ON / OFF!
03590 043B 0D0A             FDB    $0D0A,
03600 043F 42               FCC    /BACKSPACE = DELETE LAST ENTRY/
03610 045C 0D0A             FDB    $0D0A,
03620 0460 45               FCC    /ESC = CLEAR BUFFER FOR NEW TUNE/
03630 047F 0D0A             FDB    $0D0A,
03640 0483 52               FCC    !RETURN = CHANGE: TEMPO / NOTE SIZE /
03650 04AF 0D               FCB    $D,$A,$A,,
03660 04B4 55               FCC    /UNUSED KEYS: 1 5 8 J A F K :/
03670 04D0 0D               FCB    $D,$A,$A,,
03680 04D5 2A               FCC    /* HIT 'RETURN' TO START */
03690 04EE 04               FCB    4
03700 04EF 43       CHMENU  FCC    /CHANGE MENU:/
03710 04FB 0D               FCB    $D,$A,$A,,
03720 0500 54               FCC    /T = TEMPO/
03730 0509 0D0A             FDB    $0D0A,
03740 050D 46               FCC    /F = FORMANT/
03750 0518 0D0A             FDB    $0D0A,
03760 051C 53               FCC    /S = NOTE SIZE/
03770 0529 04               FCB    4

03790               * CNTRL CHAR.S TO HOMEUP,CLR PAGE,OUT NULLS

03810 052A 0005     CLSCRN  RMB    5
03820 052F 04               FCB    4

03840               * USED BY PROGRAM

03860 0530 0001     SIZTST  RMB    1
03870 0531 0000     TABLE   FDB    0
03880 0533 00       PROMPT  FCB    0
03890 0534 01       PFLAG   FCB    1
03900 0535 0001     TEMP    RMB    1
03910               * --- SAVED WITH TUNE ---
03920 0536 0002     NOTPTR  RMB    2
03930 0538 0104     NOTFMT  FDB    $0104
03940 053A 04       NOTSIZ  FCB    4
03950 053B 1000     TIMER   FDB    $1000
03960 053D 44       TASCII  FCB    'D
03970 053E 46       FASCII  FCB    'F
03980 053F 51       SASCII  FCB    'Q
03990       0540    BUFFER  EQU    *        TUNE BUFFER STARTS HERE

04010 A048                  ORG    $A048
04020 A048 0080             FDB    INIT
04030                       END

TOTAL ERRORS 00000
```

```
     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
-------------------------------------------------------
0000 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0010 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0020 7F 00 00 00 00 00 00 00 00 00 00 00 00 3B 10 35 2F
0030 12 00 2A 25 21 00 1C 19 00 14 00 32 00 00 00 00
0040 00 00 4F 5E 64 23 00 54 4B 16 42 00 38 3F 46 13
0050 11 2C 1F 70 1B 17 59 27 6A 1A 76 0E 00 00 0F 00
0060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0070 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

Note-code table dump.

```
     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
-------------------------------------------------------
0330                        54 45 4D 50 4F 3A 20 27 41 27
0340 20 54 4F 20 27 4F 27 20 2D 04 4E 4F 54 45 20 53
0350 49 5A 45 3A 20 57 20 48 20 51 20 45 20 53 20 2D
0360 04 46 4F 52 4D 41 4E 54 3A 20 46 20 31 20 32 20
0370 48 20 4C 20 42 20 41 20 2D 04 0D 0A 0A 00 00 50
0380 52 45 53 45 4E 54 4C 59 20 04 0D 0A 0A 3F 20 04
0390 54 55 52 4E 20 4F 4E 20 52 45 43 4F 52 44 45 52
03A0 20 41 4E 44 20 54 59 50 45 20 27 50 27 2E 0D 0A
03B0 00 00 57 48 45 4E 20 44 55 4D 50 20 49 53 20 43
03C0 4F 4D 50 4C 45 54 45 2C 20 54 59 50 45 20 27 45
03D0 27 2E 04 2A 2A 2A 20 4B 55 53 4B 42 44 20 2A 2A
03E0 2A 0D 0A 0A 00 00 43 4F 4D 4D 41 4E 44 20 4D 45
03F0 4E 55 3A 0D 0A 0A 00 00 24 20 3D 20 53 41 56 45
0400 0D 0A 00 00 53 50 41 43 45 20 3D 20 52 45 53 54
0410 0D 0A 00 00 4C 49 4E 45 20 46 45 45 44 20 3D 20
0420 50 4C 41 59 0D 0A 00 00 2A 20 3D 20 50 52 4F 4D
0430 50 54 20 4F 4E 20 2F 20 4F 46 46 0D 0A 00 00 42
0440 41 43 4B 53 50 41 43 45 20 3D 20 44 45 4C 45 54
0450 45 20 4C 41 53 54 20 45 4E 54 52 59 0D 0A 00 00
0460 45 53 43 20 3D 20 43 4C 45 41 52 20 42 55 46 46
0470 45 52 20 46 4F 52 20 4E 45 57 20 54 55 4E 45 0D
0480 0A 00 00 52 45 54 55 52 4E 20 3D 20 43 48 41 4E
0490 47 45 3A 20 54 45 4D 50 4F 20 2F 20 4E 4F 54 45
04A0 20 53 49 5A 45 20 2F 20 46 4F 52 4D 41 4E 54 0D
04B0 0A 0A 00 00 55 4E 55 53 45 44 20 4B 45 59 53 3A
04C0 20 31 20 35 20 38 20 5D 20 41 20 46 20 4B 20 3A
04D0 0D 0A 0A 00 00 2A 20 48 49 54 20 27 52 45 54 55
04E0 52 4E 27 20 54 4F 20 53 54 41 52 54 20 2A 04 43
04F0 48 41 4E 47 45 20 4D 45 4E 55 3A 0D 0A 0A 00 00
0500 54 20 3D 20 54 45 4D 50 4F 0D 0A 00 00 46 20 3D
0510 20 46 4F 52 4D 41 4E 54 0D 0A 00 00 53 20 3D 20
0520 4E 4F 54 45 20 53 49 5A 45 04 10 16 00 00 00 04
0530 04 00 00 00 01 27 05 40 01 04 04 10 00 44 46 51
```

Prompt dump.

Robert L. Leffert
86 Shawmont Lane
Willingboro NJ 08046

E-x-t-e-n-d Your Micro

Having the proper tools always makes any job much easier. The Mullen Extender Board—with built-in logic probe—looks like it should be just the thing for troubleshooting.

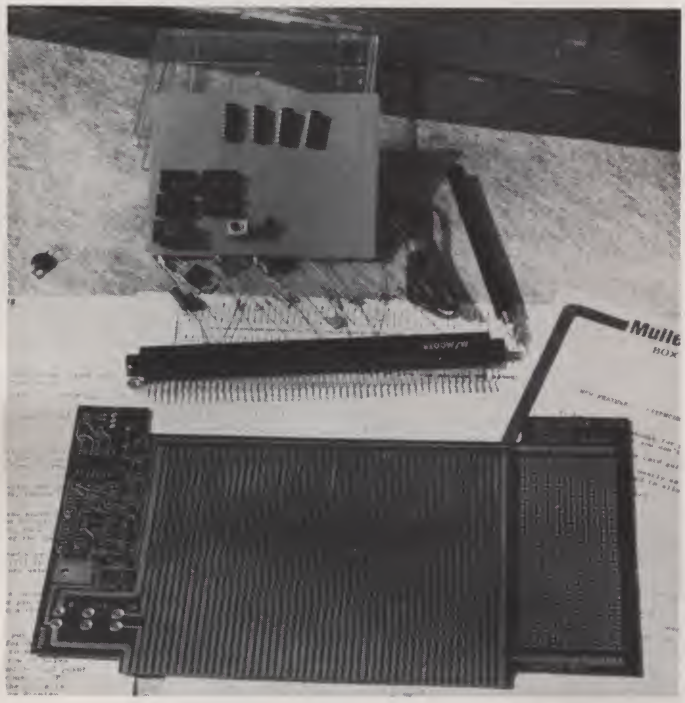
I have read many product reports and have made purchase-choice decisions based on what I read—with about a .500 satisfaction quotient. Each product report should include a brief background of the writer. An "expert" too often tends to be either overly critical or brushes over minor problems that can really stump us average guys.

My Background

I have been a ham for 25+ years. I teach high-school math, but my college major and graduate studies have been in the field of psychology. My hardware (electronic, not computer) experience is quite extensive, but I still have much to learn about digital circuits.

Several months ago I decided that I really needed an extender board for troubleshooting. Having read several articles on how to make your own printed circuits, I got a double-sided, copper-clad board and cut it to size. Then I began to draw the lines for the lands. Have you ever tried to draw 50 parallel, even-width lines with .125 inch spacing center-to-center with one of those fiber-tipped pens?

I was on about the 30th or so line when my January 1978 copy of *Kilobaud* arrived, and I took time out to see what was new. There in the New Products section was a heading, "Extender Board with Built-in Logic Probe." Within minutes my fiber-tipped pen, drawing board and T square were back in the garage (that's where I store everything except my car) and my check for $35 (the kit now costs $39) was in an envelope addressed to Mullen Computer Boards, PO Box 6214, Hayward CA 94545. It took a little over three weeks for my personal check to clear and for the kit to arrive.



The kit: before.

The Kit

I was favorably impressed with the packaging and the appearance. Small parts were packed in a clear plastic box; the PC board and edge connector were wrapped separately in poly bags; and eleven pages of assembly instructions, schematic for the logic probe and parts placement diagram were packed flat. Also included were two sets of edge-connector labels—one with voltage lands and pin-number identification only, the other with the "standard" Altair (S-100) bus labels. I was especially impressed with the appearance of the PC board—silver lands with gold-plated fingers on a satin black background—jewelry quality!

Initial Assembly. I began by taking pictures of the unassembled kit with the idea of writing this article. Assembly was direct, with no problems.

Checkout. After checking the logic probe, I was even more impressed with this Mullen product. It is such a logical combination that I only wonder why no one had it on the market a couple of years ago!

I had received a tentative OK from *Kilobaud* for this review article and was only waiting for my pictures to be finished and enlarged. When I received them every one had a light streak from a stuck shutter!

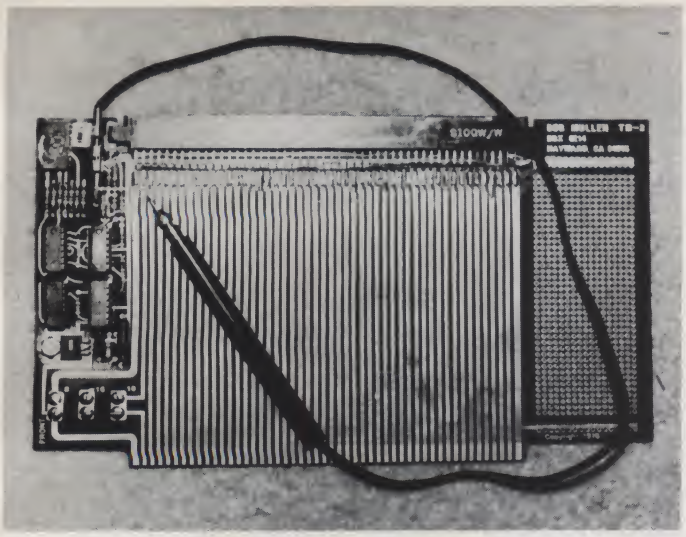
I got on the phone to Mullen to ask for a photo of their kit and of the finished board and explained why I wanted them. Keith Britton told me that the version I had was already obsolete and that the new version would be ready for shipment in a few more days. But he also said that he would try to locate and furnish me with photos of my version.

A few days later I received a phone call from Keith saying that no photos were available, but that he would furnish me with a preliminary kit of the new version. Before the end of the week the new kit had arrived.

The New Kit

The new version of the kit is packaged just as impressively as the original. Preliminary assembly instructions read as follows:

1. Rip open the package.
2. Assemble.



The board: ready to go.

3. Use.

Assembly. Soldering the 100 connections of the socket to the lands is an onerous job; however, it is made easy by the form of the pins, which have been pre-bent so there is a pressure fit to start with. The printed circuit for the logic probe is not too crowded and went together with no solder bridges the first time. Parts placement seems logical and well engineered.

Checkout. No problems at all. The logic display is a seven-segment type mounted at the upper left of the board: H for high (above 2.25 V), L for low (below 0.8 V), P for pulse (transition from High to Low logic) and O for open or neutral Tri-state. The P for pulse holds on for about .3 of a second, but there is a switch for a pulse holder when you are looking for a rarely occurring pulse that might be missed during a blink of the eyes.

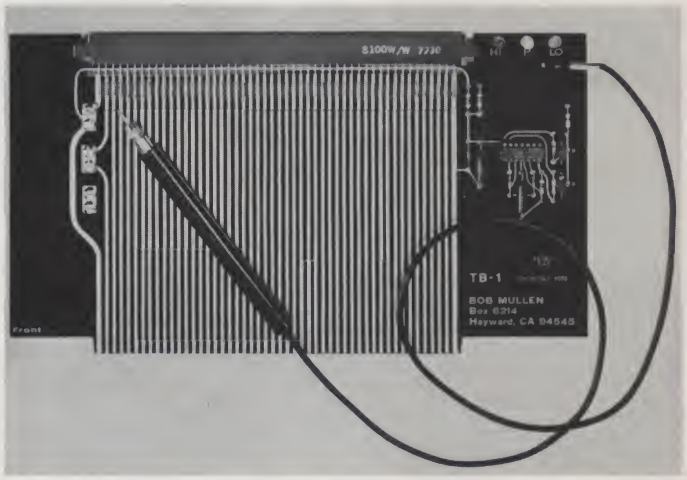
The decimal point also lights with the H. It is possible to get an idea of the duty cycle by watching the brightness of the point. If P is lighted and the decimal point is bright, the circuit under test is Hi pulsing Lo. If the P is lighted and the decimal point is not, then the circuit is Lo pulsing Hi. If the decimal point is medium brightness, Hi-Lo cycles are about equal. It won't replace an oscilloscope, but it is better than a wild guess.

The +8, +16 and −16 volt lines (1, 51, 2 and 52) have jumper links so you can fuse a line with a fine wire while troubleshooting a new board. (Eight volts at 15 or 20 Amps will create a lot of heat across a short! I had one that literally boiled away the copper land without blowing the fuse in the power supply.) The links may also be replaced with an ammeter for current measurement or with switches so that power can be cut on the board under test and removed from the circuit without shutting down the entire computer. (Bob Mullen *strongly* recommends against this!)

On the right side of the board are 765 plated-through holes for user-designed circuits. The two top rows are regulated +5 V and the bottom two are tied to ground. My first use for this area will be to add a row of red, amber and green LEDs at the top of the board for High, Pulse and Low using the circuit that Mullen's original board used. I think I can catch the colored LEDs a little easier with peripheral vision than by trying to read the H, L, P, O of the seven-segment readout.

Conclusion

Everyone who builds kits or original boards for the S-100 bus needs an extender board and a logic probe. This is a fine combination. I only wish I had had mine two years ago. ■



The board: original version.

✓ *Reader Service—see page 179*

Adrian R. Thornton
6404 Overton Rd.
Louisville KY 40228

The BASIC BASIC Renumberer

This H8 owner overcame a renumbering deficiency. You, too, can benefit from his efforts.

My first disappointment with the Heathkit H8 came when I found out that the Extended Cassette BASIC had no provision for renumbering BASIC programs. My second disappointment came when I added the H17 Extended Disk BASIC and there was still no provision for renumbering BASIC files. I understand that some other BASICs also have this deficiency.

If you've ever had to insert 20 statements in the middle of 20 consecutively numbered statements, you are aware of the inconvenience of not having the renumbering capability. And I'm sure we've all copied printed programs from articles and experienced the frustration of having to continuously shift in and out of BASIC's automatic numbering function. You may also have noticed a greater degree of difficulty in reading and debugging an inconsistently numbered program.

I wrote this utility program to fill my software gap, and it was used to renumber itself for your and my convenience. You will find it unusual in that it is a BASIC program whose input and output is another BASIC program. It is also unlike many programs in that it is predominantly a string manipulation program with little mathematics.

Program Processing

The Renumberer makes three separate passes through the BASIC file being renumbered: pass 1 (lines 10-520), pass 2 (lines 530-810) and pass 3 (lines 820-1340).

On pass 1 a cross-reference table is initialized in the string variable S$(1-5). On this pass the source file is scanned for references to internal line numbers (i.e., 'THEN xxx', 'GOTO xxx', etc.). Each unique line number reference it finds is expanded to five digits and added to the cross-reference table. (Although a given line number may be referenced from many different locations, there will be only one "unique" line number entry for that line in the cross-reference table.) At the end of pass 1, each entry in the table is stored as: "old line #\blanks" (e.g., 00032\ ).

Pass 2 replaces the source file line numbers with the desired renumber sequence. As each line number is replaced, the cross-reference table is searched for an entry for the old line number. If an entry is found, the last five bytes of the entry are then filled with the new resequenced line number. After each source line is renumbered, it is written to a temporary work file. At the end of pass 2, each entry in the cross-reference table looks as follows: "old line #\new line #" (e.g., 00032\00050).

Pass 3 reads the resequenced source file created by the second pass from the temporary work file. On this pass all line number references are replaced by the resequenced line number as it is assigned in the cross-reference table. As each line is completed it is written back into the original source program file.

This three-pass approach results in a relatively slow running program. However, since only one line of code needs to be in memory at one time, the number of lines in the source program to be renumbered is unimportant. The only constraining factor is the number of unique line number references to be replaced.

The Renumberer is currently set up with a 1265-byte cross-reference table (array S$(1-5), as mentioned above), which will hold 115 unique line number entries. This will probably be large enough to handle any program even an enthusiastic programmer is likely to write. (For example, the DOCUFORM program (*Kilobaud*, August 1978, p. 22) contains over 400 lines of code, over 200 line number references, but only slightly more than 100 "unique" line number references, and so would not overflow the five-member S$ cross-reference array.) If, however, you get carried away, simply increase the DIMension of S$ by changing the variable D5 in line 90.

Program Structure

My current system has 16K of RAM. When you subtract the area required for the Extended Disk BASIC, the RAM required by the system monitor and the user RAM required by the disk operating system, less than 3 1/2K of core remains for program use. Of this, the cross-reference table will require at least 1265 bytes.

Therefore, the Renumberer has been broken into 3K or smaller modules by writing each of the three passes as a separate program. By using the CHAINing facility of the H8 Disk BASIC, the three passes execute sequentially; pass 2

Program listing.

```
TYPE RENUMBAS.BAS
00010 REM  *** BASIC BASIC-RENUMBERER ***
00020 REM WRITTEN BY ADRIAN THORNTON, JULY, 1978
00030 REM
00040 LINE INPUT "INPUT FILE ?  ";A1$
00050 OPEN A1$ FOR READ AS FILE #1
00060 A2$="SY1:RENUMFL.WRK"
00070 OPEN A2$ FOR WRITE AS FILE #2:CLOSE #2
00080 INPUT "ENTER RESEQ 'BEG,INCR':  ";B9,I9:B8=B9
00090 C5=6:D5=5:DIM C$(C5),S$(D5)
00100 C$(1)=" THEN ON ":C$(2)=" THEN GOSUB ":C$(3)=" THEN GOTO ":C$(4)=" THEN "
00110 C$(5)="GOTO ":C$(6)="GOSUB ":Z$="00000":J=1:L9$="<LAST"+"LINE>"
00120 REM
00130 REM
00140 REM PASS #1  --BUILD LINE # REFERENCE TABLE--
00150 REM
00160 PRINT "BEGIN PASS #1"
00170 LINE INPUT #1,;1$:I1=6
00180 REM LOOK FOR MULTI-STMT SEPERATOR (:), AND CHECK FOR REM TYPE STMTS
00190 N$="":I2=MATCH(I$,":",I1+1):IF MID$(I$,I1+1,4)="REM " THEN 410
00200 REM LOOK FOR FIRST KEYWORD STRING
00210 X=999
00220 FOR K=1 TO C5:C1$=C$(K):Y=MATCH(I$,C1$,I1):IF Y<>0 AND Y<X THEN X=Y:C$=C1$
00230 NEXT K:IF X=999 THEN 380
00240 IF I2<>0 AND X>I2 THEN 380
00250 REM CHECK FOR SPECIAL 'THEN ON' CASE
00260 IF C$<>C$(1) THEN 290
00270 FOR X=X+LEN(C$) TO X+25:FOR K=5 TO 6:IF MID$(I$,X,LEN(C$(K)))=C$(K) THEN C$=C$(K):GOTO 290
```

overlays the core used by pass 1, and pass 3 overlays pass 2.

This core-hoarding is done, of course, at the expense of a lot of disk I/O overhead. If you do not have the CHAINing facility with your BASIC and/or have a sufficient amount of memory (at least 5K free for user program), you can copy the three separate modules as one continuous program by making the following modifications:

DELETE/ 420-520
CHANGE/ 290 GOSUB 1260
DELETE/ 800-810

Details, Details

Note that a remark statement with the character string "<LASTLINE>" in it must be the last line in a source program file to be renumbered. The Renumberer uses this identifier to detect the last line of the source program for end-of-file processing.

BASIC files read from disk by the H8 are in a noncompressed, source-image format. In other words, the BASIC line you keyed in is the same line you'll see when it is read from the file.

Not all BASICs store programs in this manner. For example, the H8 Cassette BASIC stores its program in a secret format of hieroglyphics with no *information* to decode it. If your BASIC does this, you'll have to forget about renumbering it and be content with the knowledge that the secret code requires less space to store.

If, however, your BASIC only compresses blanks out of the source, the Renumberer can be modified for your needs. The array C$(x) contains the line number reference keywords. These are the character strings it uses to find line number references (e.g., 'GOTO', 'GOSUB', etc.).

The C$(x) strings currently contain leading and trailing blanks per H8 BASIC standards. If blanks are compressed from your source keywords, simply change the C$ variables to correspond to the strings you will need to be looking for.

If your BASIC has additional keywords (e.g., 'ELSE'), then increase the DIMension of C$(x) in line 90 by redefining C5 and

```
00280 NEXT K:NEXT X
00290 GOSUB 450
00300 IF LEN(N$)<>6 THEN 380
00310 IF LEN(S$(J))>=253 THEN J=J+1:IF J>D5 THEN PRINT 'S$ TOO SMALL-INCREASE D5':CLOSE #1:END
00320 REM IF LINE # NOT IN TABLE, ADD IT
00330 FOR K=1 TO J:IF MATCH(S$(K),N$,1)<>0 THEN 370
00340 NEXT K
00350 S$(J)=S$(J)+N$+"      "
00360 REM CHECK FOR COMPOUND BRANCH
00370 IF A$="," THEN I1=R+1:X=I1:C$="":N$="":GOTO 290
00380 IF I2<>0 THEN I1=I2:GOTO 190
00390 GOTO 170
00400 REM CHECK FOR 'LASTLINE' INDICATOR
00410 IF MATCH(I$,L9$,I1+1)=0 THEN 380
00420 CHAIN "RENUMBS2.BAS"
00430 REM
00440 REM KEYWORD HAS BEEN FOUND.  EXPAND FOLLOWING LINE #, IF ANY, TO 5 DIGITS
00450 FOR Q=X+LEN(C$) TO LEN(I$):IF MID$(I$,Q,1)<>" " THEN 470
00460 NEXT Q:GOTO 510
00470 FOR R=Q TO LEN(I$):A$=MID$(I$,R,1):IF A$=" " OR A$="," OR A$=":" THEN 500
00480 IF A$<"0" OR A$>"9" THEN 510
00490 N$=N$+A$:NEXT R
00500 N$=LEFT$(Z$,5-LEN(N$))+N$+"/"
00510 RETURN
00520 REM <LASTLINE>
>


 TYPE RENUMBS2.BAS
00530 REM MODULE 2 --- BASIC, BASIC-RENUMBERER
00540 REM
00550 REM PASS #2  --RENUMBER LINES & COMPLETE REF TABLE--
00560 REM
00570 PRINT "BEGIN PASS #2"
00580 CLOSE #1
00590 OPEN A1$ FOR READ AS FILE #1
00600 OPEN A2$ FOR WRITE AS FILE #2
00610 REM READ LINE AND SAVE LINE #
00620 LINE INPUT #1,;I$:L1$=LEFT$(I$,5)+"/"
00630 REM BUILD REPLACEMENT LINE #
00640 B9$=MID$(STR$(B9),2,LEN(STR$(B9))-2)
00650 REM LOOK FOR OLD LINE # IN C.R. TABLE
00660 FOR K=1 TO J:X=MATCH(S$(K),L1$,1):IF X<>0 THEN 690
00670 NEXT K:GOTO 710
00680 REM STUFF NEW LINE # AFTER CORRESPONDING OLD LINE #
00690 S$(K)=LEFT$(S$(K),X+5)+LEFT$(Z$,5-LEN(B9$))+B9$+RIGHT$(S$(K),LEN(S$(K))-X-10)
00700 REM RENUMBER CURRENT LINE AND WRITE IT TO WORK FILE
00710 I$=LEFT$(Z$,5-LEN(B9$))+B9$+RIGHT$(I$,LEN(I$)-5)
00720 PRINT #2,I$
00730 REM CHECK FOR 'LASTLINE' INDICATOR
00740 IF MATCH(I$,L9$,10)<>0 THEN 770
00750 B9=B9+I9:GOTO 620
00760 REM
00770 CLOSE #1,#2:B9=B8
00780 OPEN A2$ FOR READ AS FILE #1
00790 OPEN A1$ FOR WRITE AS FILE #2:CLOSE #2:OPEN A1$ FOR WRITE AS FILE #2
00800 CHAIN "RENUMBS3.BAS"
00810 REM <LASTLINE>
>


 TYPE RENUMBS3.BAS
00820 REM MODULE 3 --- BASIC, BASIC-RENUMBERER
00830 REM
00840 REM PASS #3  --RENUMBER REFERENCES VIA REF TABLE--
00850 REM
00860 PRINT "BEGIN PASS #3"
00870 LINE INPUT #1,;I$:I1=6
00880 REM BUILD NEW LINE #
00890 B9$=MID$(STR$(B9),2,LEN(STR$(B9))-2)
00900 REM LOOK FOR MULTI-STMT SEPERATOR (:), AND REM TYPE STMTS
00910 N$="":I2=MATCH(I$,":",I1+1):IF MID$(I$,I1+1,4)="REM " THEN 1210
00920 REM LOOK FOR FIRST KEYWORD STRING
00930 X=999
00940 FOR K=1 TO C5:C1$=C$(K):Y=MATCH(I$,C1$,I1):IF Y<>0 AND Y<X THEN X=Y:C$=C1$
00950 NEXT K:IF X=999 THEN 1170
00960 IF I2<>0 AND X>I2 THEN 1170
00970 REM CHECK FOR SPECIAL 'THEN ON' CASE
00980 IF C$<>C$(1) THEN 1010
00990 FOR X=X+LEN(C$) TO X+25:FOR K=5 TO 6:IF MID$(I$,X,LEN(C$(K)))=C$(K) THEN C$=C$(K):GOTO 1010
01000 NEXT K:NEXT X
01010 GOSUB 1270
01020 REM CHECK FOR COMPOUND BRANCH
01030 IF A$="," THEN I$=LEFT$(I$,R-1)+"\"+RIGHT$(I$,LEN(I$)-R)
01040 IF LEN(N$)<>6 THEN 1170
01050 REM LOOK FOR OLD LINE # ENTRY IN C.R. TABLE
01060 FOR K=1 TO J:X=MATCH(S$(K),N$,1):IF X<>0 THEN 1090
01070 NEXT K:GOTO 1170
01080 REM REPLACE OLD LINE # REF WITH NEW LINE # FROM C.R. TABLE
01090 FOR I=6 TO 10:IF MID$(S$(K),X+I,1)<>"0" THEN 1110
01100 NEXT I
01110 R=R-1:I$=LEFT$(I$,Q-1)+MID$(S$(K),X+I,11-I)+RIGHT$(I$,LEN(I$)-R)
01120 IF I2<>0 THEN I2=Q+11-I:REM ADJUST FOR COMPOUND LINE CONTRACTION
01130 IF A$<>"," THEN 1170
01140 FOR R=7 TO LEN(I$):IF MID$(I$,R,1)="\" THEN 1160
01150 NEXT R
01160 I$=LEFT$(I$,R-1)+","+RIGHT$(I$,LEN(I$)-R):I1=R+1:X=I1:C$="":N$="":GOTO 1010
01170 IF I2<>0 THEN I1=I2:GOTO 910
01180 REM WRITE LINE BACK TO ORIGINAL FILE
01190 PRINT #2,I$:B9=B9+I9:GOTO 870
01200 REM CHECK FOR 'LASTLINE' INDICATOR
01210 IF MATCH(I$,L9$,I1)=0 THEN 1170
01220 PRINT #2,I$:CLOSE #1,#2
01230 OPEN A2$ FOR WRITE AS FILE #1:CLOSE #1:END
01240 REM
01250 REM
01260 REM KEYWORD HAS BEEN FOUND.  EXPAND FOLLOWING LINE #,IF ANY, TO 5 DIGITS
01270 FOR Q=X+LEN(C$) TO LEN(I$):IF MID$(I$,Q,1)<>" " THEN 1290
01280 NEXT Q:GOTO 1330
01290 FOR R=Q TO LEN(I$):A$=MID$(I$,R,1):IF A$=" " OR A$="," OR A$=":" THEN 1320
01300 IF A$<"0" OR A$>"9" THEN 1330
01310 N$=N$+A$:NEXT R
01320 N$=LEFT$(Z$,5-LEN(N$))+N$+"/"
01330 RETURN
01340 REM <LASTLINE>
>
```

```
          <<  Program Before Renumbering >>

00001 REM RENUMBER TEST --- NON-FUNCTIONAL BASIC PROGRAM
00007 REM
00009 IF X<>0 THEN GOTO 15
00010 ON X+Y GOTO 16,17,18:GOTO 25
00015 IF X<4 THEN ON X GOSUB 16,17,40:END
00016 GOSUB 40:GOTO 41
00017 X=X+X:IF X<>Y THEN GOSUB 40:X=X^3:RETURN
00018 GOSUB 40:ON Y GOSUB 17,40:IF Y=1 THEN 9
00019 RETURN
00025 IF Y=X THEN ON Y GOTO 9,41
00030 GOTO 9
00040 Y=Y-X:RETURN
00041 END :REM <LASTLINE>
>


          << Renumbering of Program >>

 RUN
INPUT FILE ?  SY1:RENUMTST.DOC
ENTER RESEQ 'BEG,INCR':  100,10
BEGIN PASS #1
BEGIN PASS #2
BEGIN PASS #3
END AT LINE  1220
*


          << Program After Renumbering >>

00100 REM RENUMBER TEST --- NON-FUNCTIONAL BASIC PROGRAM
00110 REM
00120 IF X<>0 THEN GOTO 140
00130 ON X+Y GOTO 150,160,170:GOTO 190
00140 IF X<4 THEN ON X GOSUB 150,160,210:END
00150 GOSUB 210:GOTO 220
00160 X=X+X:IF X<>Y THEN GOSUB 210:X=X^3:RETURN
00170 GOSUB 210:ON Y GOSUB 160,210:IF Y=1 THEN 120
00180 RETURN
00190 IF Y=X THEN ON Y GOTO 120,220
00200 GOTO 120
00210 Y=Y-X:RETURN
00220 END :REM <LASTLINE>
>
```

Example 1.

add the new C$(x) definition to line 110. (Note that lines 270 and 990 expect 'GOTO' and 'GOSUB' to be located in C$(5) and C$(6).)

This program could be used to renumber Cassette BASIC as long as it is stored in the required image format. The disk reads and writes could be replaced with tape I/O subroutines. You would, of course, need an input deck and an output deck since the Renumberer writes each line before reading the next. Between passes a wait loop could be incorporated to provide time to change or rewind cassettes. It sounds like a lot of hassle, but keep in mind the hassle required to re-key the program . . . until you make your next change.

Pass 2 writes the partially modified source to a workfile. The workfile is defined in line 60 as the variable A2$. You may have to respecify this workfile name to conform to your system or system configuration. It may also be necessary to respecify the CHAINing file names in lines 420 and 800 for the same reason if you are using the multi-program configuration.

At the end of processing, line 1230 OPENs the workfile and then CLOSEs it. This frees the disk space allocated to the workfile, although the name remains in the disk directory.

The Renumberer uses a function called MATCH. The format is MATCH(exp1,exp2,exp3), where:

exp1 = string to be searched
exp2 = string to search for
exp3 = position in exp1 to begin searching for exp2

If a match of exp2 is found in exp1, then the position of that string in exp1 is returned. If a match is not found, a zero is returned.

If your BASIC does not have this function, it can be replaced with a search loop using the above information.

Notice that the index I1 is set to 6 after reading a record in lines 170 and 870. This is the displacement in I$ to begin searching for keywords. For the H8 Disk BASIC, this can be done because all line numbers are five digits long, padded left with leading zeros when necessary (see the listings for examples). If your BASIC does not guarantee a fixed length line number, it will be necessary to add a small routine after the input statements to set I1 to the displacement of the first program information in each line.

Using the Renumberer

First, make a backup copy of the program you wish to renumber, as a precaution.

Execute the program.

Enter the name of the program you want renumbered.

Enter the beginning line number followed by the increment you want between successive line numbers.

Now get up and get a beer or read a book or something. You can occasionally check the terminal to see which pass is currently executing. After a lot of grinding and clattering, the Renumberer will end pass 3.

Dump the new listing and make a couple of test runs before deleting the temporary backup copy.

Example 1 shows the Renumberer being put through its paces. The input is a nonfunctional test program of BASIC statements. This input is stored in a file called 'SY1:RENUMTST.DOC'. Following the input are the processing statements from the Renumberer. At the bottom is a listing of the renumbered output program.

In Conclusion

Keep in mind that the Renumberer "replaces" the original program file with the renumbered version. It would be advisable to make a backup copy of the original before renumbering. A hardware error, keying error or subtle program bug could change the BASIC Program Renumberer into a BASIC Program Shredder, capable of destroying your most prized program in three deft passes.

If you own an H8, copy the program as is, or if your system has sufficient memory, copy it as a single program, making the three necessary changes mentioned above. If you are using a different BASIC and your files are stored in the required format, make any necessary modifications as previously described. Then enjoy the appearance and flexibility of your renumbered BASIC programs. ■

A1$	File name of program to be renumbered
A2$	Name of work file
C$(x)	Line reference 'keywords'
S$(x)	Cross reference table
B8	Beginning resequence number
B9	Current resequence number
I9	Resequence increment
Z$	Zeros
J	Highest S$ subscript
L9$	End-of-file identifier string
I$	Input/Output line
I1	Low keyword index
I2	High keyword index
N$	Line number referenced by a keyword
C$	Number of keywords to search for
D5	Number of strings in cross-reference table
Q,R	Temporary line indices
L1$	Line number of I$
C$,X,Y,K,I	Temporary work variables

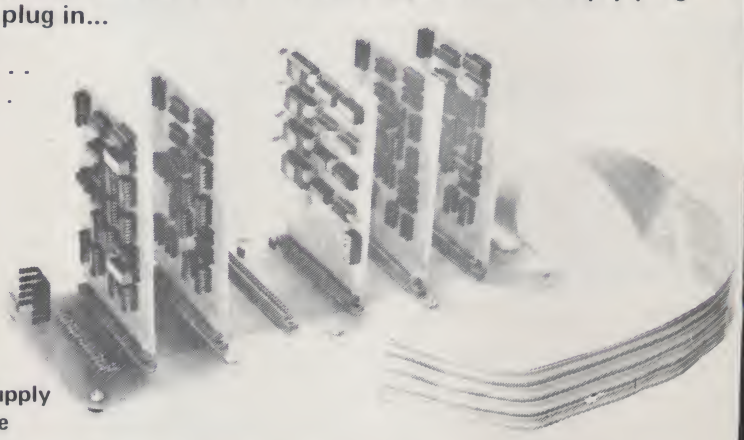
Variable usage table.

NOW! A Full Support System for TRS-80*

GPA's Motherboard is the key to unlimited expansion of your TRS-80's capabilities. Simply plug the Motherboard into your TRS-80, then plug in...

32K of RAM . . . EPROM firm ware . . .
Disk Control . . Data Acquisition . . .
Parallel I/0 . . . Serial I/0 . . .

by inserting modular cards into the Motherboard.
No additional power supply is necessary.
GPA's Motherboard has its own!
Why pay more for less?



GPA's QUALITY DESIGN INCLUDES:

- 6-44 Pin Edge Connectors
- +5V, -5V, +12V, -12V External Power Supply
- 40 Pin Ribbon Connector to plug into the Keyborad Connector.
- Active Termination on all Bus Lines.
- Fully buffered.

The Motherboard is Only $149.95
(F.O.B. California Residents Add 6% Sales Tax) Assembled & Tested

TRS-80* HARDCOPY INTERFACE!

Only $69.95
Assembled and Tested

INTRODUCING...Handshake option for High Speed Line Printers.....$79.95

also available...
Full Input/Output Model at..... $149.95

No modification of your system is necessary. The GPA TRS-80 Hardcopy Interface plugs directly into the back of your TRS-80 (or your Expansion Interface). RS-232-C or 20 ma. current loop compatible.

Take advantage of GPA-EXPANSION CARDS

MEMORY CARDS: Now, with Fortran compliers available for your TRS-80, additional expansion memory is a must!

- Cards with
  - Sockets only $119.95
  - 16K of 4116 Dynamic Ram w/card 224.95
  - 32K of 4116 Dynamic Ram w/card 329.95
- All cards come equipped with sockets to accomodate 32K of Ram

EPROM FIRMWARE CARD

- Put those valuable subroutines in firmware. Don't waste time loading and unloading tapes and disks
- 4 sockets for 2708 or 2716 Eproms 79.95

SERIAL I/O CARD: Here's what you've been asking for, a full serial terminal interface, with RS-232C or 20MA Current loop, Input/output capabilities 99.95

PARALLEL I/O CARD: Control functions in the outside world, monitor and store real time events 79.95

- Two parallel output ports.
- Dip switches select Ports (0-254)

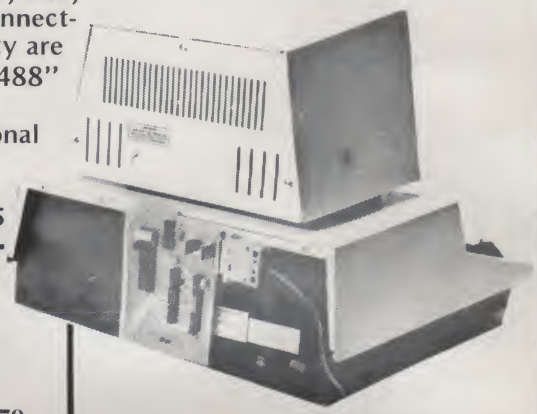
Please Inquire about our Disk Controller & D/A Cards.

PET*HARDCOPY INTERFACE

GPA's HARDCOPY INTERFACE plugs into the "IEEE-488" bus on the back of the Commodore "PET"* Computer.

The interface comes with Selectable baud rate (110, 300, 600, 1200, 2400, 4800, 9600) and a DB-25 female printer connector. Both RS-232C and 20 ma. current loop compatibility are contained in one. Best of all you still retain the "IEEE-488" bus. GPA has provided you with an "IEEE-488" edge connector, that allows you to extend the bus for additional devices. Handshake supported.

Assembled and Tested.....$ 79.95
NOW AVAILABLE...Full Input/Output Model at.. $ 149.95



* TRS-80 Trademark of Radio Shack
* PET Trademark of Commodore

The Sign of Integrity

GPA ELECTRONICS, INC. ✓G24

Post Office Box 7410 — Oakland, CA 94601

(707) 984-6270
or
(415) 459-1221

ALL PRODUCTS ASSEMBLED, TESTED and GUARANTEED

VISA master charge

DEALER DIRECTORY

Palo Alto CA

Systems available for immediate delivery: word processing; multiprogramming, multi-user work in process; business; medical/dental billing and accounts receivable. Software and hardware guaranteed **Byte of Palo Alto, 2233 El Camino Real, Palo Alto CA 94306, 327-8080.**

San Leandro CA

From personal computers to small systems: North Star, Horizon, DD, Sorcerer, Godbout, TRS-80, Imsai, Verbatim, terminals, printers, floppies, boards, software, books, magazines. Custom programming. **Computer Store of San Leandro, 701 MacArthur Blvd., San Leandro CA 94577, 569-4174.**

Torrance CA

If you're serious, come see us! Complete systems for business, special and personal applications. Packaged and proprietary software. Custom programming. Quality: Apple II, Exidy, Alpha Micro and CP/M systems. Serving southern California better. **Omega Micro Computers, 3535 Torrance Blvd., Suite 10, Torrance CA 90503, 370-9456.**

Denver CO

Experimenters' Paradise. Electronic and mechanical components. Computer People, Audio People, Hams, Robot Builders, Experimenters. Open six days a week. **Gateway Electronics Corp., 2839 W. 44th Ave., Denver CO 80211, 458-5444.**

Stamford CT

The Computer Place in downtown Stamford features Apple, North Star, DEC and others. Specializing in small business applications. We are a DEC OEM and supply integrated business systems with word processing. Books, magazines, peripherals and good advice. **The Computer Place, 21 Atlantic St., Stamford CT 06901, 356-1920.**

Wilmington DE

Turnkey biz system. Hardware and software. Custom formatting available; checks, invoices, reports. Micropolis drives/MDOS/BASIC. FORTRAN/CP-M/CBASIC possible. SASE for our low prices. **ComputerEASE, Inc., PO Box 4156, Wilmington DE 19807, 998-5589.**

Washington DC/Northern VA

Authorized Dealer. Processor Technology, Corp.; PET; Sorcerer; KIM. Word processing, data-base management, general accounting software. Books & magazines. Parts & accessories. Complete service center. **Tyson's Computer Emporium, 1984 Chain Bridge Rd., McLean, VA 22101, 821-8333;** and **Georgetown Computer Emporium, 3286 M St., NW, Washington DC 20007, 337-6545.**

Pompano Beach FL

Business systems, personal systems, whatever the application, we can help. Consulting, programming, education and maintenance. Service, support and professionalism at affordable prices. **Computer Age Inc., 1308 N. Federal Hwy., Pompano Beach FL 33062, 946-4999.**

Arlington Hts. IL

Lowest prices, never undersold, postpaid in USA—Teletype 43 keyboard printers—Midwest Scientific Instruments Computers—SS-50 bus peripherals—open 6-11 PM daily. **Data Mart, 914 East Waverly Drive, Arlington Heights IL 60004, 398-8525.**

Aurora IL

Personal and small business microcomputer systems, peripherals, software, books and magazines. Apple, North Star, Cromemco systems. Weekdays 12-8, Saturdays 10-5. **Farnsworth Computer Center, 1891 N. Farnsworth Ave., Aurora IL 60505, 851-3888.**

Chicago IL

Staffed by computer professionals. Largest selection of books and magazines in the Chicago area. Specialists in CP/M, Apple Computer and Alpha microsystems. **Data Domain of Schaumburg, Plaza de las Flores, 1612 E. Algonquin Rd., Schaumburg IL 60195, 397-8700.**

Naperville IL

Discount Prices: Creed Teletypes, optical scanners, Solid State Music products, Integrand mainframes, Vista floppy-disk systems, many other items, complete hardware and software systems. **Wilcox Enterprises, 25W178-39th St., Naperville IL 60540, 420-8601.**

Laurel MD

Exidy Sorcerer & accessories, Central Data memory boards, G2 software library, full line of ham & SWL equipment. **The Comm Center, Inc., Laurel Plaza, Rte. 198, Laurel MD 20810, 792-0600. Washington: 953-9535.**

Boston MA

Largest computer store in New England with widest selection of microprocessor and LSI 11-based systems. Two miles north of the Mass. Pike, just off Route 128, exit 49. **Computer Mart of Massachusetts, 1395 Main Street (Rt. 117), Waltham MA 02154, 899-4540.**

Westboro MA

Supplies and accessories for the TRS-80. Minidisks; printer paper and forms. Colorful fabric dust covers. Line filters, programs. Custom programming and consulting. Computerized bookkeeping service. **August Automation, 28 Milk St., Westboro MA, 366-0870.**

Worcester MA

Computer products for personal and business systems. Stocking full line of Instant Software, G2, and Personal Software for TRS-80, Apple, PET, Sorcerer. Open six days. **Computer Packages Unlimited, Centerwood Terrace, 244 West Boylston St., West Boylston MA 01583, 829-2570.**

Grand Rapids MI

Full-line microcomputer store. Ohio Scientific—Equinox—PolyMorphic Systems—Digital Systems—Godbout—Dynabyte—Thinker Toys—Meca—North Star. **Micro Computer World, 313 Michigan St., N.E., Grand Rapids MI 49503, 451-8972.**

St. Paul MN

Ohio Scientific Authorized Dealer. Complete business and personal computer systems. Store hours: Mon-Sat 9-5. Custom software design and programming. To take advantage of our many years of computer experience call, write or visit: **Frisch Computer Systems, Inc., 1415 Arcade St., St. Paul MN 55106, 771-7569.**

St. Louis MO

Experimenters' Paradise. Electronic and mechanical components. Computer People, Audio People, Hams, Robot Builders, Experimenters. Open six days a week. **Gateway Electronics Corp., 8123-25 Page Blvd., St. Louis MO 63130, 427-6116.**

Oilmont MT

Business Systems for accounting and word processing. Business software for 6800 MSI, Mini-Flex and North Star CBASIC. Our products save time and money. **Compumont, Inc., 2708 W. Main, Oilmont MT 59466, 337-3015.**

Brooklyn NY

Specialists in analyzing business needs; consulting, software and complete turnkey systems for mini/micro computers. Metro NY. **Micronomics Business Systems, Inc., 1061 54th St., Brooklyn NY 11219, 436-0381.**

Rome-Utica NY

Ohio Scientific Authorized Dealer. Computers for personal, business, education and industry. Software for accounting, information management, word processing, education, business, personal and games. **Comp-u-Ware, 9057 Main St., Westernville NY 13486, 827-4487.**

White Plains NY

Processor Technology, North Star HORIZON, Apple II, Commodore PET and KIM; full line of books, components and peripherals; classes in our Seminar Room. **The Computer Corner, 200 Hamilton Avenue, White Plains NY 10601, 949-3282.**

Akron OH

We've got it all. Business systems. Personal systems. Software packages. Custom programming. Terminals. Printers. Service and books. Easy freeway access. 10 AM to 6 PM Monday-Saturday. **The Basic Computer Shop, Fairlawn Plaza, 2671 West Market St., Akron OH 44313, 867-0808.**

York PA

Personal and small-business systems. Components and peripherals. Books, magazines, information. Hobbyists welcome. 1/2 block from Business 83 at Iron Bridge. **G.Y.C. Co., 51 Hamilton Ave., York PA 17404, 854-0481.**

Houston TX

Experimenters' Paradise! Electronic and mechanical components for computer people, audio people, hams, robot builders, experimenters. Open six days a week. **Gateway Electronics, Inc., 8932 Clarkcrest, Houston TX 77063, 978-6575.**

Houston TX

TRS-80 professionals! Business systems for immediate delivery. Complete business and hobby software library. Custom programming. Centronics, TI, Pertec, NEC, Selectraprint. Modifications and repair of TRS-80. **Houston Micro-Computer Technologies, Inc., 5313 Bissonnet, Bellaire TX 77401, 661-2005.**

Madison WI

Specializing in complete tested systems for unique applications Cromemco, TEI, Compucolor II, Godbout, North Star, Vector Graphic, Hazeltine, Perkin-Elmer, U.S. Robotics and much more. **Magic Lantern Computers, 6414 Copps Ave., Madison WI 53716, 221-8643.**

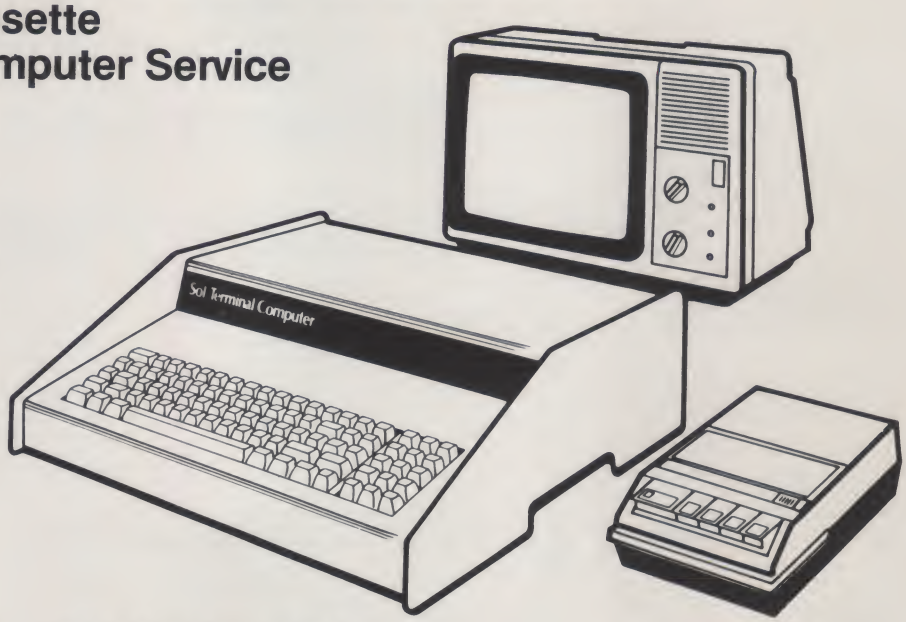
Shop the store nearest you!

Dealers: Listings are **$15** per month in prepaid quarterly payments, or one yearly payment of **$150**, also prepaid. Ads include 25 words describing your products and services plus your company name, address and phone. (No area codes or merchandise prices, please.) Call Marcia at 603-924-7138 or write *Kilobaud MICROCOMPUTING*, Ad Department, Peterborough NH 03458.

✓ Reader Service—see page 179

New Sol-20 Software

on Cassette
from E S V Computer Service



Sol System II-A
from Processor Technology

SALES/INVENTORY: This is a cassette sales package that will permit entry of business sales, sales person, item, and stock/inventory control number. The system will also flag any item that has reached a selected re-order point due to stock depletion. SALES/INVENTORY is designed to use two cassette tape units *in a read-write* operation. Report generation is based on the data on the cassette tape files. Cassette tape handling is done by software and by computer prompting to minimize data errors from improper operator actions. Uses Extended Cassette BASIC. Comes on CUTS cassette tape with documentation.
Order Number EC-011 ..... $35.00

MONEY MANAGER: A collection of approximately 100 programs used to solve many financial problems encountered in the business world. From interest calculations, loan repayments, rates, depreciation schedules, and principal investment amounts, to trend lines and exponential curve fit. The MONEY MANAGER will handle many of the financial problems you are likely to be confronted with during any business day. The documentation also contains sample problems with answers to aid the user in becoming familiar with program operation. Uses Extended Cassette BASIC. Program comes on CUTS cassette tape with documentation.
Order Number EC-024 ..... $40.00

CONVERSION: This comprehensive unit conversion program handles unit conversions for weight, volume, distance, speed, power, angular units, temperature and more. The operator keys in the quantity and units. The program then outputs the converted quantity in other measurement systems in a list. CONVERSION uses Extended Cassette BASIC and requires a Sol-20 with 32K or RAM. Program comes on CUT cassette tape with documentation.
Order Number EC-016 ..... $19.50

BYTE-FINDER: This machine language utility will search or search/replace 1, 2, or 3 bytes in memory. The program has four versions, loading at 0000H, 4000H, 7000H and D000H. The operator selects starting and ending search addresses, number of bytes to be searched, data to be searched for, and optional bytes for replacement. An output is generated giving all memory addresses where the selected data were found. This is very handy for programmers who make many program patches or modify I/O routines, etc. Comes on 1200 baud CUTS cassette tape.
Order Number EC-022 ..... $19.50

DISA-UTILITY: This support software is used to read the type files generated by the DIS-ASSEM-BLER. It will permit the user to format the file for compatibility with ALS-8 by determining the hex byte count required in each line. The file may then be edited with the ALS-8 EDIT command and saved on tape for later use or re-assembly. The utility treats the input file as a fixed length block so that large files may be treated without having memory overflows. This utility is not required when using the DIS-ASSEM-BLER with the Helios II disk system.
Order Number EC-023 ..... $25.00

SINK: Three dimensional war game of your naval fleet versus the computer's fleet. Your fleet consists of destroyers in your home port and submarines hidden in the enemy port. The computer has destroyers in his port and submarines in your home port. The destroyers move and fire depth charges at the opposing hidden submarines. But watch out! The submarines can fire back with torpedoes. Size of the playing area can be changed to fit memory or alter the game complexity. SINK runs in Extended Cassette BASIC on your Sol-20. 32K RAM is required for size 5 ports. 48K is recommended for larger ports. SINK comes on 1200 baud CUTS cassette.
Order Number EC-017 ..... $25.00

AMAZN: Find your way through the maze! Compete against an opponent and try for a new record time! This maze game contains a random maze generator which gives you a new maze every time. The cursor control keys are used to control movement through the maze. Written in machine language, AMAZN will run on a Sol-20 with 8K of RAM. Program comes on 1200 baud CUTS cassette.
Order Number EC-018 ..... $19.50

MINE FIELD: A new machine coded game from that mad-man that developed SINK for your pleasure. Some people say he has some sort of death wish syndrome, but we find the rubber room he occupies during program development to be fairly safe. This game requires that you traverse an enemy mine field without getting blown to pieces or gunned down by enemy machine guns. Comes on standard 1200 baud CUTS cassette tape.
Order Number EC-025 ..... $19.50

ORDERING INFORMATION: Order by name and number. All orders must be COD or prepaid. Add 3% for freight. Texas residents add 5% for sales tax. Cassette tapes are first generation tapes in standard 1200 baud CUTS format and are guaranteed for one year. Disks are Helios PTDOS compatible and are guaranteed for six months. Dealerships available.

COMPUTER PORT

926 N. COLLINS
ARLINGTON, TEXAS 76011 ✓C80
(817) 469-1502

✓ Reader Service—see page 179

Shavasan Meditation Program

Relax, read this article, use the program, relax . . . relax . . .

Dr. Ian Thurston
22 Concord Avenue
Dundas, Ontario L9H 1R6
Canada

Mention meditation to most people, and they'll conjure up pictures of Indian temples, droning sitars, burning incense and long-haired gurus. Certainly, the farthest thing from their minds is a computer.

Nevertheless, thanks to the program Shavasan, you can transform your home number cruncher into your very own guru!

True, your personal guru can't show you the way to nirvana . . . but it *will* teach you something almost as useful: Shavasan, an ancient Indian discipline that's more relaxing than an afternoon nap and cheaper than a bottle of booze to boot!

What is Shavasan?

Shavasan is a yoga technique that many people find very relaxing. Unlike most meditative techniques, though, it does not demand awkward postures, extreme concentration or chanting. In fact, thanks to your computer, it doesn't even demand a costly guru.

Shavasan actually consists of controlling a simple involuntary response we all share: breathing. The practice of Shavasan sounds like simplicity itself; after finding a comfortable position in a quiet room, you just sit still and breathe in . . . hold it . . . breathe

```
0001  REM PROGRAM SHAVASAN
0002  REM PROGRAMMER: IAN THURSTON DATE: 31/08/1978
0003  REM SYSTEM: TRS-80, 16-K, LEVEL-II
0004  REM
0005  REM OPENING DIALOG
0006  REM
0010  CLS
0011  REM CLS CLEARS TRS-80 MONITOR SCREEN
0020  PRINT "HELLO. I'M YOUR FRIENDLY COMPUTER GURU"
0030  PRINT "I'M GOING TO TEACH YOU TO RELAX WITH SHAVASAN"
0040  PRINT
0050  PRINT "SHAVASAN LETS YOU USE YOUR BREATHING"
0060  PRINT " TO CALM YOUR BODY AND MIND."
0070  PRINT
0080  PRINT "FIRST, YOU NEED A COMFORTABLE CHAIR."
0090  PRINT "NEXT, TURN DOWN THE ROOM LIGHTS."
0100  PRINT "NOW, SIT DOWN AND RELAX FOR A MOMENT."
0104  REM
0105  REM WAIT FOR RESPONSE, THEN GET PULSE DATA
0106  REM
0110  GOSUB 1000
0120  GOSUB 2000
0130  PULSE (1) = 4*BEATS
0140  PRINT "HOW MANY MINUTES DO YOU WANT TO RELAX FOR (1-30)"
0150  INPUT MINUTES
0160  IF MINUTES < 1 OR MINUTES > 30 GOTO 150
0170  CLS
0180  PRINT "ALL YOU HAVE TO DO IS CONCENTRATE ON"
0190  PRINT "THE FOUR STAGES OF BREATHING:"
0200  PRINT
0210  PRINT TAB(10) "1) INHALE"
0220  PRINT TAB(10) "2) HOLD YOUR BREATH"
0230  PRINT TAB(10) "3) EXHALE"
0240  PRINT TAB(10) "4) HOLD IT"
0250  PRINT
0260  PRINT "JUST WATCH THE SCREEN AND DO WHAT IT SAYS."
0270  PRINT "TRY NOT LET YOUR ATTENTION WANDER."
0280  GOSUB 1000
0290  REM OPERATING PART OF PROGRAM: 3 NESTED LOOPS
0295  REM
0300  CLS
0310  MOMENT = 450
0315  REM MOMENT SETS DURATION OF INNERMOST LOOP
0320  FOR A = 1 to 8*MINUTES
0330  FOR B = 1 to 4
0340  READ MESSAGE$, TIME
0345  REM 'TIME' IS # OF 'MOMENT'S MESSAGE$ IS DISPLAYED
0350  CLS
0360  PRINT@540, MESSAGE$
0370  FOR C = 1 TO TIME*MOMENT
0380  NEXT C
0390  NEXT B
0400  RESTORE
0410  NEXT A
0420  DATA INHALE, 2, HOLD IT, 1, EXHALE, 2, HOLD IT, 2
0424  REM
0425  REM CLOSING DIALOG
0426  REM
0430  CLS
0440  PRINT "YOU HAVE COMPLETED SHAVASAN"
0450  PRINT
0460  PRINT "ONCE AGAIN";
0470  GOSUB 2000
0480  PULSE(2) = 4*BEAT
```

Program listing.

out . . . hold it . . . and so on. And that is *all* you do; if you find your mind wandering, you must go back to paying attention to your breathing.

Why should this relax you? Cardiologist Herbert Benson believes that techniques such as Shavasan invoke something called the "relaxation response." Unlike the "fight-or-flight response" that gears up your body and mind to meet any threat to you, the "relaxation response" puts your body in neutral and your mind "on hold."

So effective is Shavasan that it has been taught to patients suffering from hypertension as a successful means of reducing their blood pressure. The technique, which is usually practiced for 20 minutes a day, takes most people several weeks to master. (It is surprising that something so simple should be so hard to learn—but then, relaxing is a *skill*.)

Shavasan sounds easy enough that you may be asking yourself why you need a guru—flesh-and-blood *or* semiconductor—to teach you. It turns out that almost everyone learns this sort of technique best when "someone" (in this case, your trusty computer) guides him through.

As a bonus, since you have to watch the video screen to pace yourself, your attention is so well focused that it isn't likely to wander for long. (By the way, don't try Shavasan on a Teletype-based system unless you're stone deaf. The clangs, wheezes and assorted rattles of an ASR-33 in mid-line are enough to "unrelax" anyone but a corpse.)

How the Program Works

The program has three divisions. An opening dialogue gives the "meditator" instructions about the Shavasan technique and asks him to measure his pulse for 15 seconds to provide baseline physiological data for later comparison. Since the display requires several "pages" (I prefer to avoid scrolling), the meditator must respond after each page is displayed in order to bring up the next one. For example, he must specify through the input variable MINUTES how long he wishes to relax—I recommend between 15 and 30 minutes a day.

After the opening dialogue, there is a three-level nest of timing loops. The first level determines how many inhale-hold, exhale-hold cycles will occur as a function of MINUTES (roughly eight cycles per minute). The second level successively READs each of the four instructions that make up one breathing cycle, along with the associated TIME parameter.

The third and deepest level simply kills time for either one MOMENT or two, depending on the TIME parameter just read. I chose a value of MOMENT that provides a delay of about one second on my TRS-80. You may wish to increase or decrease this value if you find the pace too fast or too slow for comfort.

When the "meditation" is complete, the program asks the meditator to measure the pulse rate for another 15 seconds for comparison with the earlier baseline data. Most people find a considerable drop in their pulse rates after meditation—which is indicative of successful relaxation. You may wish to keep track of this over a period of time, just to see how much you improve with practice.

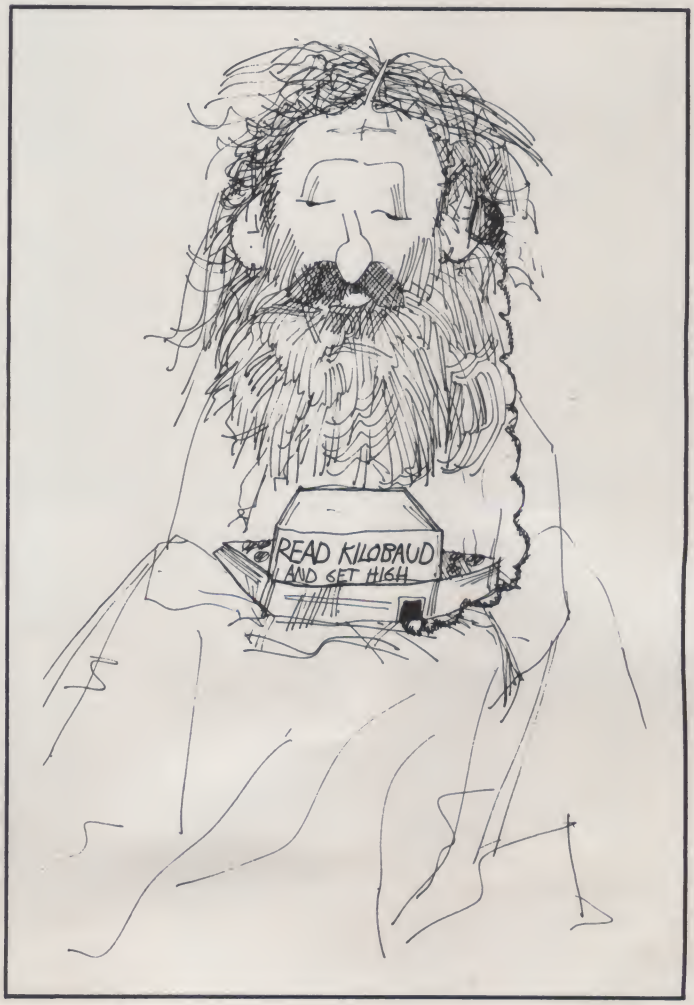
Some Words of Caution

A few people find that techniques such as Shavasan actually make them *more* tense. Should you suspect this is happening to you, by no means should you keep "hitting your head against a brick wall."

Other people find *at first* that Shavasan doesn't seem to work for them. If this applies to you, don't be discouraged! Remember: Simple as it sounds, Shavasan is a skill that may take up to three weeks of *daily* practice before conclusive results.

So plug in your computer guru and give it a try. You may not discover the seven-fold way to True Enlightenment . . . but you'll have fun trying! ■

```
0490  CHANGE = PULSE(2) – PULSE(1)
0494  REM
0495  REM FEEDBACK ON CHANGE (IF ANY) IN PULSE
0496  REM
0500  PRINT "THAT'S A CHANGE OF ";CHANGE;" BEATS A MINUTE"
0510  IF CHANGE >=0 PRINT "OOPS" ELSE PRINT "VERY GOOD"
0520  PRINT "KEEP TRYING."
0530  PRINT
0540  PRINT "THIS IS YOUR COMPUTER GURU SAYING GOODBYE."
0550  END
0994  REM
0995  REM SUBROUTINE TO WAIT FOR RESPONSE
0996  REM
1000  PRINT
1010  PRINT "WHEN YOU'RE READY TO GO ON, TYPE 'YES' "
1020  INPUT A$
1030  CLS
1040  RETURN
1994  REM
1995  REM SUBROUTINE TO GET PULSE
1996  REM
2000  PRINT "PLEASE TAKE YOUR PULSE. BEGIN TO COUNT"
2010  PRINT "BEATS WHEN THE SCREEN GOES BLANK."
2020  FOR A = 1 TO 5000
2030  NEXT A
2040  CLS
2050  FOR A = 1 to 5500
2060  NEXT A
2065  REM TIMES 15 SECONDS
2070  PRINT "HOW MANY BEATS DID YOU COUNT"
2080  INPUT BEATS
2090  CLS
2100  RETURN
```



Personal Finance System

This personal finance series winds up with a program that collects data from programs presented in parts 1 and 2, and then formats it into four useful reports, with variations.

James McClure
1019 Van Kirk St.
Philadelphia PA 19149

This is the final of a three-part series dealing with personal finance. In the two previous articles, I presented programs to handle personal accounts payable and accounts receivable. In this article I will detail a program that takes the data collected by the other two programs and formats it into several useful reports. These can be used for preparing a tax return, for balancing the family budget and for keeping an eye on the fruit of your hard labor.

The system offers four basic reports, with several variations of each. When the reports program is activated, a menu of the available functions is printed (see Fig. 1). These functions are labeled A through E. One can be selected by typing its corresponding letter in response to the OPTION prompt. Note that the allowable options are printed only once, when the system is initialized. If it is desired to have them reprinted, a ? may be typed.

```
                TOTAL OF GENERAL EXPENDITURES FROM JAN 1978
                      AS OF 12/30/78

MON ---------+---------+---------+---AV----+---------+---------+--------

JAN ************************************    $475.15
FEB ******************************    $390.33
MAR ****************    $211.09
APR ************************    $329.02
MAY **************************    $368.90
JUN ********************************************************************
JUL ******************************    $398.23
AUG ************************************    $512.60

    ---------+---------+---------+---------+---------+---------+--------
AV =     $448.17
```

Fig. 4a. Graph with totals printed.

CATEGORY	AMOUNT	% OF TOTAL INCOME
PAY DEPOSITED	$7008.00	90.20%
INTEREST	$140.23	1.80%
DIVIDENDS	$32.50	0.42%
MISCELLANEOUS	$481.10	6.19%
TOTAL DEPOSITS	$7769.56	

Fig. 3. Function B—income breakdown.

```
REPORT GENERATOR                                DATE: 12/28/78


ALLOWABLE OPTIONS ARE:

A=SPENDING BREAKDOWN              B=BREAKDOWN OF DEPOSITS
C=SPENDING GRAPH                  D=PAY STUB TOTALS
E=RETURN TO OPERATING SYSTEM


OPTION (?=LIST OPTIONS)?
```

Fig. 1. Menu of allowable options.

```
SHORT FORM SPENDING BREAKDOWN FOR 12/28/78

ACCOUNT  -2 - SAVINGS ACC WITHDRAWAL    $100.00     1.24%
ACCOUNT  -1 - MISCELLANEOUS             $271.63     3.36%
ACCOUNT   0 - CASH                     $1250.00    15.44%
ACCOUNT   1 - APARTMENT (RENT)         $2430.19    30.03%
ACCOUNT   2 - TUITION (COLLEGE)        $3720.00    45.96%
ACCOUNT   3 - BELL TELEPHONE             $68.57     0.85%
ACCOUNT   4 - ELECTRIC CO               $180.70     2.23%
ACCOUNT   5 - WATER CO                   $72.13     0.89%

              TOTAL EXPENDITURE         $8093.22
```

Fig. 2. Function A.

The Reports

The first available report is function A, the spending breakdown. There are two variations of this report: long form and short form. The long-form spending breakdown is thorough, and it is best to have it printed out. It provides a list of all checks written during the year, categorized according to account number, with totals for each account. This feature is handy for figuring the itemized deductions on your tax return.

The short-form spending breakdown calculates and prints the total amount of money spent per account, along with this total expressed as a percentage. This is useful in comparing the relative activity of one account to another. An example of this report is given in Fig. 2. In this fictitious sample, meant to represent the financial picture of a college student, it is easy to see that all is as it should be (?!), with college tuition taking the largest bite of income. Often, however, imbalances can go unnoticed in a large family, and function A is useful in getting a quick overview as to how much is being spent, and where.

The second basic report offered by the system, function B, is a breakdown of deposits. As you will recall, the accounts-receivable program divided deposits into two general categories: paycheck deposits and miscellaneous deposits. This is convenient for entry, but come tax time something more specific is needed. Therefore, the deposit breakdown function searches all the miscellaneous deposits for recurring patterns in the first six letters of the account names. Any name appearing more than once in the first six letters of the deposit records is flagged, and a category with that name is created.

From this point on, any records bearing the name are entered under that category. After all the records have been scanned, the categories are totaled and printed. All the remaining records with names that were not repeated are then totaled, and this total is printed

```
          TOTAL OF GENERAL EXPENDITURES FROM JAN 1978
                AS OF 12/30/78

MON ---------+---------+---------+---AV----+---------+---------+--------

JAN ***********************************

FEB *****************************

MAR ***************

APR ***********************

MAY ***************************

JUN ********************************************************************

JUL ******************************

AUG **************************************

    ---------+---------+---------+---------+---------+---------+--------
AV =     $448.17
```

Fig. 4b. Graph with totals suppressed.

```
          TOTAL OF GAS EXPENDITURE FROM JAN 1978
                AS OF 12/30/78

MON ---------+---------+---------+---AV----+---------+---------+--------

JAN **************************************************     $44.90

FEB ****************************************************     $46.47

MAR ***********************************************************

APR ************************************************     $43.00

MAY *********************************************     $40.12

JUN *****************************     $25.71

JUL **************     $12.66

AUG **********     $8.99

SEP **********     $9.25

OCT *******************     $17.00

NOV *************************     $22.17

DEC *****************************************     $36.63

    ---------+---------+---------+---------+---------+---------+--------
AV =      $29.98
```

Fig. 5. Graph of gas expenditure.

```
          TOTAL OF MISCELLANEOUS FROM JAN 1978
                AS OF 01/01/79

MON ---------+---------+---------+---AV----+---------+---------+--------

JAN          $0.00

FEB ****************************************     $225.56

MAR ******************************************************     $301.20

APR ********************************************************     $310.99

MAY ************************************************     $269.12

JUN ******************************************     $234.77

JUL ********************     $111.29

AUG ******************     $100.00

SEP *************************     $141.87

OCT *********************************     $182.44

    ---------+---------+---------+---------+---------+---------+--------
AV =     $187.72
```

Fig. 6a. Graph with FIX = 0.

as MISCELLANEOUS.

As an example, suppose you regularly receive social-security checks and deposit them under miscellaneous using the account name SOC SEC XXX, where XXX is the abbreviation of the month of the check. The income breakdown function will recognize the recurring pattern SOC SEC and will create a separate category with this name. It will then calculate the total of all of the social-security checks and print this, along with the percentage of total deposits it represents.

To give a better idea of how function B works, a sample report is pictured in Fig. 3. Notice that the majority of deposits were paychecks and that the computer found only two commonly occurring names in the rest of the deposit records: INTEREST (e.g., from the savings account) and DIVIDENDS. All other records were totaled under MISCELLANEOUS.

It is also important to note that function B considers all the deposits lumped together, not separated into deposits to checking and deposits to savings. This is why INTEREST, undoubtedly deposited in the savings account, is listed with PAY DEPOSITED, which probably went into the checking account.

At this time it might also be pertinent to mention that the computer can only total deposits, not income. Therefore, in figuring your taxes, if you received $1000 from some source, but only deposited $600, you must remember to account for the other $400 on your return. Of course, if you make a habit of depositing all of your earnings (even if only temporarily), there will be no problems.

The third basic report provided by the system, function C, is a spending graph. Although this is of little use in preparing a tax return, it is handy for comparing family expenditures from month to month. Since this is the most complicated function, I will describe in detail the steps necessary in using it.

When the function is first selected, the computer will prompt for the starting date of the graph. This may be any month, followed by a slash (/), followed by the last two digits of the year. For example, 04/79 would request a starting date of April 1979. For convenience, if it is desired to start with a month in the current year, the slash and the year may be omitted entirely. Thus, 12 would imply a starting date of December, the current year.

Next, the computer will prompt for an ending date. Use the same format rules as for the starting date. The graph may extend from one year to another, provided that enough data is available and that no more than 12 months are to be graphed. For example, it is perfectly legal to request a starting date of 09/77 and an ending date of 05/78. It would be improper, however, to specify a starting date of 07/78 and an ending date of 07/79, as this would require a graph of more than 12 months.

After receiving a starting and ending date, the computer will then ask whether it is to graph general expenditure or a specific account. If you request a specific account, it will then ask for the account number. Afterwards it will ask whether or not totals should be printed. This is largely a matter of personal preference; if you would like to know exactly how much was spent each month, then type

```
            TOTAL OF MISCELLANEOUS FROM JAN 1978
                  AS OF 01/01/79

MON ---------+---------+---------+---AV----+---------+---------+--------

JAN   NO DATA

FEB **********************************    $225.56

MAR ************************************************    $301.20

APR ************************************************    $310.99

MAY ****************************************    $269.12

JUN ***********************************    $234.77

JUL ******************    $111.29

AUG ****************    $100.00

SEP ************************    $141.87

OCT ****************************    $182.44

    ---------+---------+---------+---------+---------+---------+--------
AV =     $208.58
```

Fig. 6b. Graph with FIX = 1.

```
                    Reports program breakdown

          General routines:

* 101     Parameter Block - Initialization of variables and arrays
  110     Menu print routine

          Major subroutines:

  1000 - 1199   Function A - Spending breakdown
  2000 - 2999   Function B - Breakdown of income
  3000 - 3999   Function C - Spending graph
* 4000 - 4099   Function D - Pay stub totals

          Input/Output subroutines:

  9000   Asks if printout is desired. If so, printing is switched to hard
          copy device.
  9100   Prints heading for spending breakdown function A.
  9200   Prints trailer for function A.
  9300   Receives answers to yes/no questions. Variable ANS is returned as
          follows:
                    -1 if response was yes
                     0 if response was no
                     1 if response was "EXIT"

  10000  Reads accounts-payable record from disk
  10100  Reads deposit record from disk
* 10500  Reads pay stub records from disk
  11500  Prints accounts-payable record to console
```

Table 1. List of program routines and subroutines (those marked with an asterisk will need modification as per text).

YES.

After all information has been entered, the computer will total the amount spent each month and use this to calculate the length of the bar to be printed for that month. The graph is scaled according to the arithmetic mean of the expenditures per month. For instance, if the average amount spent per month is $800, then the center of the graph will represent $800, the left-hand side $0 (as always) and the right-hand side 2*800 = $1600 (since the graph is linear). For convenience, the average is printed just below the graph.

Fig. 4 contains several examples of graphs; 4a is a general-expenditure graph. Fig. 4b is the same graph, but without the monthly totals. Notice that due to the length of the bar for June, no total was printed. (This is an automatic feature of the program, and it can be eliminated if a printer with greater line width is available.)

Although function C is not of any direct use in filing a tax return, it does have many possible applications. Suppose that a married couple is experiencing difficulty making ends meet at certain times of the year, while at other times plenty of cash is available. By examining a graph of general expenditure, they can decide which months of the year tend to be tighter in terms of debt. By saving money during months of extra cash, they can avoid these tight situations in the future.

As another example, consider the graph of expenditures for gas, shown in Fig. 5. The variation in monthly totals parallels the seasons; totals are highest in the cold months of November to March and lowest in the warm summer months. This graph represents a fictitious East Coast household that uses gas for heating, and it warns of possible cash-flow problems during the months of highest gas consumption. In fact, this family would do better to opt for a constant payment plan, if offered by their local natural-gas company. By having the monthly payments fixed at an average amount, bottlenecks can be avoided.

As you can see, thoughtful interpretation of spending graphs can yield a great deal of knowledge regarding the working of your personal finances, and possibly save money in the process.

Unfortunately, as with all graphs, function C has its flaws. Since the arithmetic mean is used to scale the graph, a low total for one month (i.e., $0) will distort the average. But there may be instances where, for one reason or another, data is unavailable for one month; this will result in a total expenditure of $0 for that month. To compensate for situ-

System Files

1. CURRENT.DAT
   Purpose: Holds records of current bills (current accounts)
   Type: Random access file with blocked records 72 bytes in length
   Format: Record # 1 - Pointer to next free record
   Records # 2..n - records of current bills with the following fields:
   1 - Integer - Account number
   2 - String - Account name
   3 - Real - Total amount of bill
   4 - Real - Amount remaining to be paid
   5 - String - Date due

2. HISTORY.DAT
   Purpose: Holds records of the payment of bills
   Type: Random access file with blocked records 72 bytes in length
   Format: Record # 1 - Pointer to next free record
   Records # 2..n - History records with the following fields:
   1 - Integer - Account number
   2 - String - Account name
   3 - Real - Amount paid
   4 - Integer - Check number if paid by check, else zero
   5 - String - Date of payment

3. PAY$STUB.DAT
   Purpose: Holds data from pay stubs
   NOTE: The following specifications are for the programs as supplied. Since this part of the system must be modified to fit individual requirements, the final specifications may vary considerably.
   Type: Random access file with blocked records 250 bytes in length
   Format: Record # 1 - Pointer to next free record
   Records # 2..n - Pay stub records with the following fields:
   1 - String - Pay stub code
   2 - String - Date of pay check
   3 - String - Ending date of period of check
   4..26 - Real - Fields from pay stub (see fig. 7 for a list of the names of these fields)

4. BANK$ACC.DAT
   Purpose: Holds current savings and checking account balances
   Holds records of deposits to savings and checking accounts
   Type: Random access file with blocked records 50 bytes in length
   Format: Record # 1 - Pointer to next free record
   Record # 2 - Record of checking account balance with the following fields:
   1 - Real - Checking account balance
   2 - String - Date of last checking account transaction
   Record # 3 - Record of savings account balance with the following fields:
   1 - Real - Savings account balance
   2 - String - Date of last savings account transaction
   Records # 4..n - Deposit records with the following fields:
   1 - Character - "C" or "S" denoting checking or savings deposit
   2 - String - Name of source of deposit
   3 - Real - Amount of deposit
   4 - String - Date of deposit

Table 2. List of files used by the personal-accounts system.

PAY STUB TOTALS AS OF 12/28/78

BI-WEEKLY	$12000.00
P.I.ABS.DED.	$0.00
OTHER ABS.DED.	$0.00
BASE EARNINGS	$12000.00
P.I.ABS. DAYS	$0.00
P.I.ABS. PAY	$0.00
PERS. LEAVE	0
GROSS EARNINGS	$12000.00
FED.TAXABLE EARNS.	$12000.00
FED.TAX	$2400.00
SOC.SEC.EARNS.	$12000.00
SOC.SEC.TAX	$720.00
CITY TAX	$516.00
STATE DED.	$240.00
UNION DED.	$120.00
H.I.PREMIUM	$144.00
RET.EARNS.	$12000.00
RET.DED.	$624.00
HEALTH PLAN DED.	$0.00
BLUE CROSS	$192.00
MAJOR MED.	$24.00
MED. SURGICAL	$12.00
NET PAY	$7008.00

Fig. 7. Function D.

Program listing.

```
        REM ***************
        REM REPORTS GENERATOR
        REM
        REM JAMES MCCLURE
        REM JULY 1,1978
        REM ***************
101     REM ********** PARAMETER BLOCK **********
        REM IDENTIFY DATA FIELDS ON PAY STUB
        REM STRING FIELDS ONE AND TWO MUST CONTAIN THE PAY STUB CODE
        REM AND DATE RESPECTIVELY!
        STRING.FIELDS=3 REM NUMBER OF STRING DATA FIELDS
        NUMERIC.FIELDS=23 REM NUMBER OF NUMERIC DATA FIELDS
        GROSS.PAY=8 REM NUMERIC FIELD CONTAINING GROSS PAY
        NET.PAY=23 REM NUMERIC FIELD CONTAINING NET PAY
        DIM R(NUMERIC.FIELDS),R$(STRING.FIELDS),T(NUMERIC.FIELDS)
        REM FIELD HEADINGS
        DATA "STUB CODE","CHECK DATE","PERIOD ENDING","BI-WEEKLY"
        DATA "P.I.ABS.DED.","OTHER ABS.DED.","BASE EARNINGS"
        DATA "P.I.ABS. DAYS","P.I.ABS. PAY","PERS. LEAVE"
        DATA "GROSS EARNINGS","FED.TAXABLE EARNS.","FED.TAX"
        DATA "SOC.SEC.EARNS.","SOC.SEC.TAX"
        DATA "CITY TAX","STATE DED.","UNION DED.","H.I.PREMIUM"
        DATA "RET.EARNS.","RET.DED.","HEALTH PLAN DED.","BLUE CROSS"
        DATA "MAJOR MED.","MED.SURGICAL","NET PAY"
        REM CREATE A SCRATCHPAD ARRAY
        DIM ARRAY(12)
        REM INITIALIZE NUMERIC CONSTANTS
        YES=-1 : NO=0 : EXIT=1
        FIX=1 REM SEE TEXT CONCERNING THIS VARIABLE
        REM INITIALIZE STRING CONSTANTS
        FOR INDEX=1 TO 72
                AST$=AST$+"*"
        NEXT INDEX
        MON$="  JANFEBMARAPRMAYJUNJULAUGSEPOCTNOVDEC"
        F1$="###   /...................../$$####.##    #####" + \
                "     /........./"
        F2$="ACCOUNT ### - /...................../ $$#####.##    ##.##%"
        F3$="/.................../ $$#######.##"
        F3A$="/.................../       ###"
        F4$=" /.............../ $$#####.##           ##.##%"
        INPUT "TODAY'S DATE?";DATE$
110     PRINT
        PRINT "REPORT GENERATOR";TAB(50);"DATE: ";DATE$
        PRINT:PRINT:PRINT:PRINT
        PRINT "ALLOWABLE OPTIONS ARE:"
        PRINT
        PRINT "A=SPENDING BREAKDOWN";TAB(40);"B=BREAKDOWN OF DEPOSITS"
        PRINT "C=SPENDING GRAPH";TAB(40);"D=PAY STUB TOTALS"
        PRINT "E=RETURN TO OPERATING SYSTEM"
        PRINT:PRINT:PRINT:PRINT
120     INPUT "OPTION (?=LIST OPTIONS)?";OPTION$
        IF OPTION$="?" OR LEN(OPTION$) EQ 0 THEN 110
        OPTION=ASC(OPTION$)-64
        IF OPTION LT 1 OR OPTION GT 5 THEN 120
        ON OPTION GOSUB 1000,2000,3000,4000,5000
        CONSOLE
        PRINT
        GOTO 120
        REM ***************
1000    REM SPENDING BREAKDOWNS
        REM ***************
        INPUT "LONG OR SHORT FORM?";RES$
        IF RES$ EQ "EXIT" THEN 1199
        FORM=0
        IF LEFT$(RES$,1) EQ "L" THEN FORM=1
        IF LEFT$(RES$,1) EQ "S" THEN FORM=2
        IF FORM EQ 0 THEN 1000
        GOSUB 9000
        IF FORM=1 THEN STRING$="LONG" ELSE STRING$="SHORT"
        PRINT USING "& FORM SPENDING BREAKDOWN FOR &";STRING$,DATE$
        PRINT
        OPEN "CURRENT.DAT" RECL 72 AS 1
        OPEN "HISTORY.DAT" RECL 72 AS 2
        READ # 1,1;ACCOUNTS
        READ # 2,1;RECORDS
        TOTAL=0
        IF FORM EQ 1 THEN 1100
        FILE.NO=1
        FOR RECORD=2 TO ACCOUNTS-1
                GOSUB 10000
                TOTAL=TOTAL+BALANCE
        NEXT RECORD
        FILE.NO=2
        FOR RECORD=2 TO RECORDS-1
                GOSUB 10000
                TOTAL=TOTAL+TOTAL.DUE
        NEXT RECORD
1100    FOR SEARCH.ACC=-2 TO ACCOUNTS-2
                FILE.NO=1
                IF FORM EQ 1 THEN GOSUB 9100
                IF SEARCH.ACC GT 0 THEN \
                        RECORD=SEARCH.ACC+1 :\
                        GOSUB 10000 :\
                        ACC.TOTAL=BALANCE :\
                        ACC.NAME$=ACCOUNT$ \

                ELSE \
                        ACC.TOTAL=0 :\
                        ON SEARCH.ACC+3 GOSUB 1920,1910,1900
                IF SEARCH.ACC GT 0 AND FORM EQ 1 AND BALANCE NE 0 THEN \
                        DUE.DATE$="CURRENT" :\
                        TOTAL.DUE=BALANCE :\
                        BALANCE=0 :\
                        GOSUB 11500
                FILE.NO=2
                FOR RECORD=2 TO RECORDS-1
                        GOSUB 10000
                        IF ACCOUNT EQ SEARCH.ACC THEN \
                                ACC.TOTAL=ACC.TOTAL+TOTAL.DUE
                        IF ACCOUNT EQ SEARCH.ACC AND FORM EQ 1 THEN \
                                GOSUB 11500
                NEXT RECORD
                IF FORM EQ 1 THEN \
                        GOSUB 9200 :\
                        PRINT TAB(26); :\
                        PRINT USING "$$#######.##";ACC.TOTAL :\
                        TOTAL=TOTAL+ACC.TOTAL \
                ELSE \
                        PRINT USING F2$;SEARCH.ACC,ACC.NAME$, \
                                ACC.TOTAL,ACC.TOTAL/TOTAL*100
                PRINT
        NEXT SEARCH.ACC
        REM PRINT TOTAL EXPENDITURE
        PRINT
```

Reader Service—see page 179

ations like this, the variable FIX, located in the parameter block (see program listing), may be set to 1.

With FIX = 1, the computer will treat a zero total for one month as an indication that no data is available for that month, and will print a message to this effect instead of a bar on the graph. Otherwise, if FIX = 0, the computer treats the zero total no differently than any other.

For example, Fig. 6 shows two graphs of account −1 (miscellaneous). Notice that the records do not go back to January; therefore, a $0 total is printed for that month. Fig. 6a shows the graph produced when FIX = 0. With FIX = 1, the graph of Fig. 6b is produced. Notice that the average of 6a is a good 10 percent less than the correct average of $208.58 shown in the second graph.

The last report provided by the program is a total of all the fields of recorded pay stubs. This will let you know how much you paid the government in taxes, how much you earned before and how much you earned after taxes. It will also provide a total of pay withheld for social security, retirement, health plans, etc. This function can be used as a check against your W-2 form, or possibly as a substitute if the W-2 is unavailable. An example of function D is shown in Fig. 7.

Table 3. Reminders for proper operation of the system.

```
     The following are some helpful hints on the use of the entire
personal accounts package:

Account numbers:
     -Account numbers -2 through 0 are preassigned as follows:
          -2 = Savings account withdrawals
          -1 = Miscellaneous
           0 = Checks written for cash
     -Account numbers larger than zero are user-defined using function A
      of the accounts-payable program.

Console:
     -Should be scrolling type with at least 72 characters across. No
      other special features are needed.
     -Displays with less than 24 lines may experience some screen overflow.
      CTRL-S may be used to freeze the display at any time.
     -Due to the lack of stringent console requirements, a Teletype or
      similar hard copy device could be used in place of a separate
      console and printer.

Dates:
     -take the form MM/DD/YY, where M, D and Y are digits 0 to 9.
     -If a month or day only a single digit (i.e. 1/5/79) use a leading
      zero (i.e. 01/05/79).
     -In many cases, a space may be substituted if the current date is
      desired.
```

Modification

The reports program is written in a structured format similar to the accounts-payable and accounts-receivable programs and is meant for use on the following standard system:

Hardware: 8080, 8085 or Z-80 microcomputer with 28K mem-

```
IF FORM EQ 1 THEN \
        PRINT TAB(1);; :\
        PRINT USING "TOTAL EXPENDITURE $$#######.##";TOTAL :\
        PRINT \
     ELSE \
          PRINT :\
          PRINT TAB(15);; :\
          PRINT USING "TOTAL EXPENDITURE   $$#######.##";TOTAL :\
          PRINT
     CLOSE 1,2
1199 RETURN
1900 REM ACCOUNT 0
     ACC.NAME$="CASH"
     RETURN
1910 REM ACCOUNT -1
     ACC.NAME$="MISCELLANEOUS"
     RETURN
1920 REM ACCOUNT -2
     ACC.NAME$="SAVINGS ACC WITHDRAWAL"
     RETURN
     REM ****************
2000 REM BREAKDOWN OF INCOME
     REM ****************
     GOSUB 9000
     IF ANS EQ EXIT THEN 2999
     NPAY=0 : MDEP=0 : MISC=0 : MISC.TOTAL=0
     OPEN "PAY$STUB.DAT" RECL 250 AS 1
     FILE.NO=1
     READ # 1,1;RECORDS
     FOR RECORD=2 TO RECORDS-1
          GOSUB 10500
          NPAY=NPAY+R(NET.PAY)
     NEXT RECORD
     CLOSE 1
     REM *** NOW GET MISCELLANEOUS DEPOSITS ***
     OPEN "BANK$ACC.DAT" RECL 50 AS 1
     CREATE "SCRAT.$$$" RECL 72 AS 2
     PRINT # 2,1;"",0,0
     READ # 1,1;RECORDS
     FOR RECORD=4 TO RECORDS-1
          GOSUB 10100
          IF LEFT$(ACC.NAME$,8) EQ "PAY STUB" THEN 2100
          FOR RECORDM=1 TO MISC
               READ # 2,RECORDM;CATAG$,CAT,COUNT
               IF LEFT$(ACC.NAME$,6) EQ LEFT$(CATAG$,6) THEN \
                    CAT=CAT+AMOUNT :\
                    COUNT=COUNT+1 :\
                    PRINT # 2,RECORDM;CATAG$,CAT,COUNT :\
                    GOTO 2100
          NEXT RECORDM
          RECORDM=MISC+1
          PRINT # 2,RECORDM;ACC.NAME$,AMOUNT,1
          MISC=RECORDM
2100 NEXT RECORD
     CLOSE 1
     REM *** NOW TOTAL MISC DEPOSITS ***
     FOR RECORDM=1 TO MISC
          READ # 2,RECORDM;CATAG$,CAT,COUNT
          IF COUNT GT 1 THEN INCOME=INCOME+CAT \
                        ELSE MISC.TOTAL=MISC.TOTAL+CAT
     NEXT RECORDM
     INCOME=NPAY+INCOME
     PRINT : PRINT
     PRINT "    CATEGORY          AMOUNT      % OF TOTAL INCOME"
     PRINT "-------------------  ----------  ---------------------"
```

```
Deposit records:
     -When entering miscellaneous deposits in the accounts-receivable
      program, reserve the first eight characters for recurring patterns.
      This will allow function B of the reports program to operate more
      effectively. For example, if dividends are received from three
      different stocks, enter the records as:
           DIVIDENDS - GM                          GM DIVIDENDS
           DIVIDENDS - EXXON       instead of      EXXON DIVIDENDS
           DIVIDENDS - TANDY                       TANDY DIVIDENDS

Disks:
     -The personal accounts package was written to operate on a minimum
      system with one disk drive, therefore all programs assume data files
      to be on disk A (drive 0). This diskette may not be removed or
      replaced while any one of the programs is running.

Printer:
     -Must have line length of at least 72 characters. Special features
      like page eject, etc., are not used by the programs, and therefore
      are not required.
     -Before requesting a printout, make sure that the printer is switched
      on!

Responses:
     -Responses to prompts requiring a yes or no answer, or to prompts
      requiring a multiple choice MUST BE IN CAPITALS, and may be
      abbreviated to a single letter.
```

ory; one or more IBM 3740 floppy-disk drives; "Glass Teletype" console, such as ADM-3, etc.; 72-character/line hardcopy device (not absolutely necessary).

Software: CP/M disk operating system; CBASIC or CBASIC-2 compiler.

Like the accounts-receivable program, portions of the reports program must be specifically adapted to fit your pay-stub format. These modifications are described in detail in last month's article, and for the sake of brevity will not be repeated. As you can see from the program breakdown in Table 1, only three routines in the reports generator require any modification.

1. After the first 18 lines of the parameter block of the accounts-receivable program have been modifled as per the instructions in last month's article, they must be copied over to the reports program, starting at line 101. No other changes are necessary within this block.

2. In the routine for function D beginning at line 4000, only two simple changes are required. The remarks on the fourth and 24th lines of the routine explain these two cases.

3. The subroutine at line 10500 must be matched to its counterpart in the accounts-receivable program. Once the required modifications have been made to accounts-receivable, simply copy the routine beginning at line 10000 over to line 10500 in the report generator.

These three changes customize the accounts system so that it can read, store and manipulate pay-stub records in your specific format. If the programs

```
PRINT
PRINT USING F4$;"PAY DEPOSITED",NPAY,NPAY/INCOME*100
PRINT
FOR RECORDM=1 TO MISC
     READ # 2,RECORDM;CATAG$,CAT,COUNT
     IF COUNT GT 1 THEN \
          PRINT USING F4$;LEFT$(CATAG$,8), \
               CAT,CAT/INCOME*100 :\
          PRINT
NEXT RECORDM
IF MISC.TOTAL GT 0 THEN \
     PRINT USING F4$;"MISCELANEOUS",MISC.TOTAL, \
          MISC.TOTAL/INCOME*100 :\
     PRINT
PRINT "-------------------------------------------"
PRINT
PRINT USING "TOTAL DEPOSITS $$#######.##";INCOME
DELETE 2
RETURN
2999 REM ******************
3000 REM GRAPH
REM ******************
INPUT "STARTING DATE?";S.DATE$
IF S.DATE$="EXIT" THEN 3999
IF LEN(S.DATE$) LT 5 THEN S.DATE$=S.DATE$+RIGHT$(DATE$,3)
INPUT "ENDING DATE?";E.DATE$
IF LEN(E.DATE$) LT 5 THEN E.DATE$=E.DATE$+RIGHT$(DATE$,3)
MONTHS=(VAL(RIGHT$(E.DATE$,2))-VAL(RIGHT$(S.DATE$,2)))*12+ \
     VAL(E.DATE$)-VAL(S.DATE$)+1
IF MONTHS GT 12 THEN \
     PRINT "12 MONTH LIMIT EXCEEDED" :\
     GOTO 3000
PRINT "ANY SPECIFIC ACCOUNT";
GOSUB 9300     REM GET RESPONSE
ACCTS=-3
IF ANS EQ YES THEN INPUT "WHAT ACCOUNT NUMBER?";ACCTS
PRINT "WANT TOTALS PRINTED";
GOSUB 9300     REM GET ANSWER
VALU=ANS
GOSUB 9000
FILE.NO=1
S.DATE=VAL(S.DATE$)
E.DATE=VAL(E.DATE$)
S.DATE$=RIGHT$(S.DATE$,2)+"/"+LEFT$(S.DATE$,2)
E.DATE$=RIGHT$(E.DATE$,2)+"/"+LEFT$(E.DATE$,2)
OPEN "HISTORY.DAT" RECL 72 AS 1
READ # 1,1;RECORDS
FOR RECORD=2 TO RECORDS-1
     GOSUB 10000
     MONTH=VAL(DUE.DATE$)
     DUE.DATE$=RIGHT$(DUE.DATE$,2)+"/"+LEFT$(DUE.DATE$,2)
     IF (DUE.DATE$ GE S.DATE$ AND DUE.DATE$ LE E.DATE$) \
          AND (ACCTS EQ ACCOUNT OR ACCTS EQ -3) \
          THEN ARRAY(MONTH)=ARRAY(MONTH)+TOTAL.DUE
NEXT RECORD
CLOSE 1
REM PRINT HISTOGRAM
TOTAL=0
MONTH=S.DATE
3100     IF MONTH EQ 13 THEN MONTH=1
          TOTAL=TOTAL+ARRAY(MONTH)
          IF FIX EQ 1 AND ARRAY(MONTH) EQ 0 THEN MONTHS=MONTHS-1
          MONTH=MONTH+1
     IF MONTH NE E.DATE+1 THEN 3100
SCALE=TOTAL/MONTHS/34
REM GET TITLE
```

```
        IF ACCTS EQ -3 THEN ACC.NAME$="GENERAL EXPENDITURES":GOTO 3200
        IF ACCTS LE 0 THEN ON ACCTS+3 GOSUB 1920,1910,1900:GOTO 3200
        OPEN "CURRENT.DAT" RECL 72 AS 1
        READ # 1,ACCTS+1;ACC,ACC.NAME$
        CLOSE 1
3200    PRINT
        PRINT TAB(10);
        PRINT USING "TOTAL OF & FROM & 19&"; \
              ACC.NAME$,MID$(MON$,S.DATE*3,3),LEFT$(S.DATE$,2)
        PRINT TAB(10);
        PRINT USING "      AS OF &";DATE$
        PRINT
        PRINT "MON ";
        PRINT "---------+---------+---------+---AV";
        PRINT "----+---------+---------+--------"
        PRINT
        PRINT
        MONTH=S.DATE
3300            IF MONTH EQ 13 THEN MONTH=1
                PRINT USING "& ";MID$(MON$,MONTH*3,3);
                PRINT LEFT$(AST$,INT(ARRAY(MONTH)/SCALE));
                IF FIX EQ 1 AND ARRAY(MONTH) EQ 0 THEN PRINT "  NO DATA"
                IF VALU EQ NO OR POS+8 GT 72 THEN PRINT:GOTO 3400
                IF FIX EQ 0 OR ARRAY(MONTH) NE 0 THEN \
                        PRINT USING "$$######.##";ARRAY(MONTH)
3400            PRINT
                MONTH=MONTH+1
        IF MONTH NE E.DATE+1 THEN 3300
        PRINT
        PRINT "    ---------+---------+---------+----";
        PRINT "-----+---------+---------+--------"
        PRINT USING "AV = $$######.##";TOTAL/MONTHS
3999    RETURN
        REM ***************
4000    REM CALCULATE YEARLY TOTALS
        REM ***************
        GOSUB 9000
        IF ANS EQ EXIT THEN 4099
        RESTORE
        REM THE FOLLOWING LINE SETS THE DATA POINTER TO THE FIRST
        REM NUMERIC FIELD. IN THIS CASE IT IS FIELD 4, HOWEVER
        REM THIS MAY BE CHANGED.
        READ H$,H$,H$
        OPEN "PAY$STUB.DAT" RECL 250 AS 1
        READ # 1,1;RECORDS
        FOR INDEX=1 TO NUMERIC.FIELDS
                T(INDEX)=0
        NEXT INDEX
        FOR RECORD=2 TO RECORDS-1
                GOSUB 10500     REM READ RECORD
                FOR INDEX=1 TO NUMERIC.FIELDS
                        T(INDEX)=T(INDEX)+R(INDEX)
                NEXT INDEX
        NEXT RECORD
        CLOSE 1
        PRINT USING "PAY STUB TOTALS AS OF &";DATE$
        PRINT:PRINT
        FOR INDEX=1 TO NUMERIC.FIELDS
                READ H$
                REM IN MY FORMAT, NUMERIC FIELDS 5 AND 7 SHOULD NOT
                REM BE PRINTED IN DOLLARS AND CENTS FORMAT, THUS
                REM THE FOLLOWING "IF" CLAUSE.
                IF INDEX EQ 5 OR INDEX EQ 7 THEN \
                        PRINT USING F3A$;H$,T(INDEX)*100 \
                ELSE \
                        PRINT USING F3$;H$,T(INDEX)
        NEXT INDEX
        PRINT
4099    RETURN
5000    STOP
        REM ***************
9000    REM TTY QUESTION
        REM ***************
        PRINT "PRINT ON TTY";
        GOSUB 9300
        IF ANS EQ YES THEN LPRINTER
        PRINT
        RETURN
        REM ***************
9100    REM PRINT HEADING FOR SHEET
        REM ***************
        PRINT
        PRINT "ACN          ACCOUNT            TOTAL    ";
        PRINT "CHK NUM   CHK DATE"
        PRINT "---- --------------------  --------- ";
        PRINT "--------- ----------"
        PRINT
        RETURN
        REM ***************
9200    REM PRINT TRAILER FOR SHEET
        REM ***************
        PRINT
        PRINT "------------------------------";
        PRINT "------------------------------"
        RETURN
        REM ***************
9300    REM YES OR NO ANSWER
        REM ***************
        INPUT RES$
        ANS=2
        IF LEFT$(RES$,1) EQ "Y" THEN ANS=YES
        IF LEFT$(RES$,1) EQ "N" THEN ANS=NO
        IF RES$="EXIT" THEN ANS=EXIT
        IF ANS NE 2 THEN RETURN
        PRINT "PLEASE ANSWER YES OR NO";
        GOTO 9300
        REM ***************
10000   REM READ ACCOUNTS-PAYABLE RECORD FROM DISK
        REM ***************
        READ # FILE.NO,RECORD;ACCOUNT,ACCOUNT$,TOTAL.DUE, \
              BALANCE,DUE.DATE$
        RETURN
        REM ***************
10100   REM READ DEPOSIT RECORD
        REM ***************
        READ # FILE.NO,RECORD;ACCOUNT$,ACC.NAME$,AMOUNT,DATE.DEP$
        RETURN
        REM ***************
10500   REM READ PAY STUB RECORD
        REM ***************
        READ # 1,RECORD; \
        R$(1),R$(2),R$(3),R(1),R(2),R(3),R(4),R(5),R(6),R(7),R(8), \
        R(9),R(10),R(11),R(12),R(13),R(14),R(15),R(16),R(17),R(18), \
        R(19),R(20),R(21),R(22),R(23)
        RETURN
        REM ***************
11500   REM PRINT ACCOUNTS-PAYABLE RECORD TO CRT
        REM ***************
        PRINT USING F1$;ACCOUNT,ACCOUNT$,TOTAL.DUE,BALANCE,DUE.DATE$
        RETURN
        END
```

are being used with another BASIC language, such as Microsoft, etc., further modifications in addition to those already mentioned will be necessary. As an aid to those interested in such a conversion, I have listed the blocks of the program in Table 1; in addition, a list of the files used by the entire system may be found in Table 2. Further information on the general operation of the system may be found in Table 3.

Unfortunately, because of the size of the three programs, translating them for another BASIC may be a tough job. If you do not own CBASIC, but have the facilities to support it (CP/M, memory, etc.), consider purchasing it or CBASIC-2 as a second BASIC language. The cost is approximately $100, and CBASIC has many advantages over other BASICs. CBASIC is available for either Digital Research, Inc., or Software Systems, Inc. CBASIC-2 is available from Graham-Dorian Software Systems and probably Software Systems as well.

Although the modifications I have described are not difficult, the necessity of typing over 1000 lines of BASIC can stifle anyone's enthusiasm. As an alternative, I am willing to ship a diskette with all the programs for a nominal fee of $25. This covers the cost of a quality disk and first-class postage. (Please *do not* send diskettes, as these tend to clog the mailbox and arouse the suspicions of the neighbors.) The programs will be supplied in both ASCII text (source) and compiled form (object) on a CP/M-formatted disk.

Conclusion

Proper use of this three-part system can virtually eliminate the necessity of keeping paper files, except perhaps as a backup. With reports A, B and D close at hand, April should be a much more pleasant month. Balancing the budget will also be easier with the help of report C. And don't forget the multitude of smaller reports the accounts-payable and accounts-receivable programs provide. With all that help you just can't lose, so let me hear from you soon, and get started computerizing your finances. ■

Digital Research, Inc.
Box 579
Garden Grove CA 93950

Software Systems, Inc.
PO Box 145
Sierra Madre CA 91024

Graham-Dorian
Software Systems
211 N. Broadway
Wichita KS 67202

✓ *Reader Service—see page 179*

Percom CI-812 Mod

This modification helps solve a problem that was raised in an earlier article.

Charles W. Blevins
RR3, #4 Prairie St., Box 126
Auburn IL 62615

The article by Rod Hallen in *Kilobaud*, August 1978 ("Kansas City Standard," p. 48), pointed out a problem you can encounter when using both the RS-232 interface and the cassette interface on Percom's CI-812 board: namely that it is inconvenient to require the terminal and the cassette to operate at the same data rate. Fortunately, separating the cassette and terminal interfaces is relatively simple. First, the RS-232 output is inhibited during a cassette write. Second, the UART transmitter clock frequency is set for the RS-232 rate during cassette read as well as terminal operations.

The RS-232 port is disabled by adding two NPN transistors (see Fig. 1). The bit (bit 1 of port 0) that turns on the write relay, K2, holds Q_5 off during cassette write. Thus, Q_3 is kept turned off and there is no RS-232 output. The second fix is that the transmit clock input for the UART is not routed through Z10(C) (see Fig. 2). Instead, another 74LS157 IC is added. The new 2 to 1 multiplexer is controlled by bit 1 of port 0. The terminal baud rate is fed to the UART transmit clock except during cassette write. With these fixes the UART receive clock input and data input are controlled by bit 0 of port 0, while the UART transmit clock input is controlled by bit 1 of port 0.

The effect of these changes is that the RS-232 port baud rate is independent of the cassette port. The cassette rate is selected by pins 8 and 10 on the TSA connector. The software requirements are that port 0 is set to 00 for terminal I/O, 01 for cassette read and 02 for cassette write. If port 0 is set to 03, then the cassette read/write occurs at the cassette baud rate.

In summary, cassette operations are carried out at the data rate selected by connector TSA, and terminal operations occur at the strapped terminal rate. Another advantage is that binary data tapes may be written without strange characters appearing on the terminal. ■

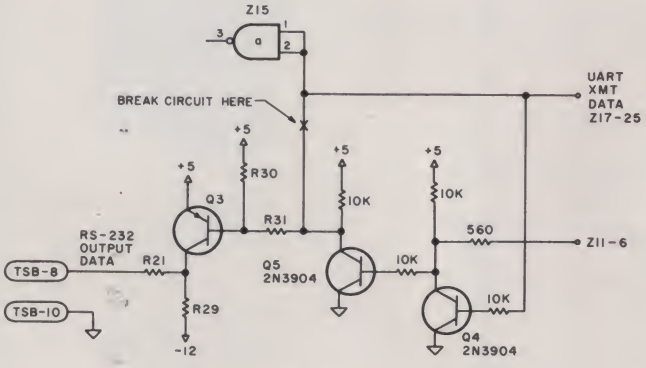


Fig. 1.

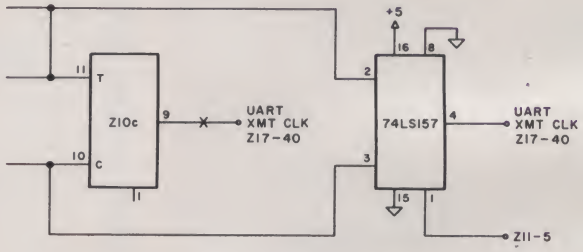
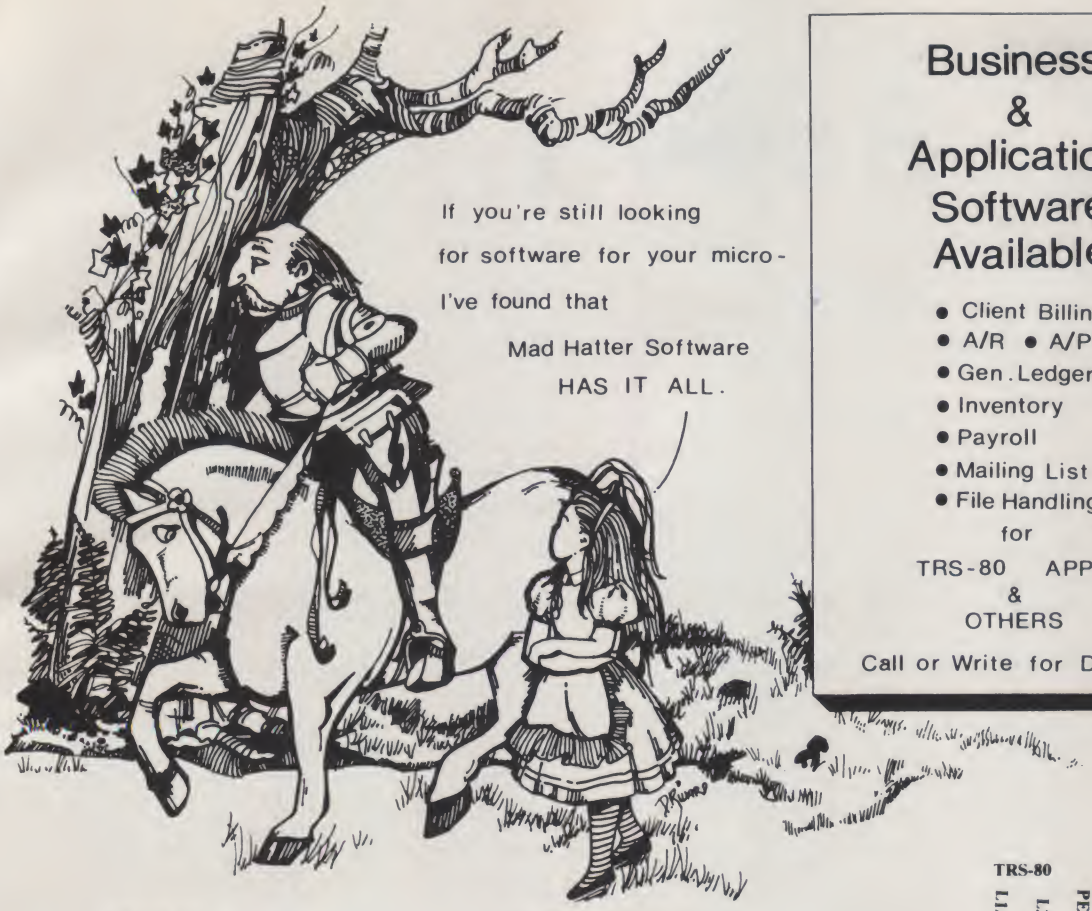


Fig. 2.

Reader Service—see page 179

MAD HATTER SOFTWARE



Business & Application Software Available

- Client Billing
- A/R • A/P
- Gen. Ledger
- Inventory
- Payroll
- Mailing List
- File Handling

for

TRS-80 APPLE

&

OTHERS

Call or Write for Details

PROGRAM	DESCRIPTION	TRS-80 L1/2	TRS-80 L2	PET	APPLE	
GALACTIC BLOCKADE RUNNER	• AN EXCITING SPACE WAR GAME WITH GRAPHICS	●		●	●	$ 9.95
SCI-FI GAME SAMPLER	• 3 GAMES— LUNAR LANDER—STAR MONSTER—SPACE BATTLE	●		●	●	$ 7.95
R/T LUNAR LANDER	• A REAL TIME LUNAR LANDER WITH GRAPHICS		●			$ 7.95
MICRO-TEXT EDITOR	• FORMAT TEXT—SAVE & LOAD TO TAPE—OUTPUT TO PRINTER		●			$ 9.95
OTHELLO III	• A STRATEGY BOARD GAME—PLAY AGAINST COMPUTER OR OTHERS	●		●	●	$ 7.95
AIR RAID	• A REAL TIME, ARCADE TYPE SHOOTING GAME IN MACH. LANG.	●				$ 14.95
MICRO-CHESS	• PLAY CHESS WITH YOUR COMPUTER—VARIOUS LEVELS OF DIFF.	●		●	●	$ 19.95
BRIDGE CHALLENGER	• DON'T WAIT FOR OTHERS TO PLAY—YOUR COMPUTER'S READY	●		●	●	$ 14.95
APPLE 21	• BLACKJACK WITH HIRES GRAPHICS				●	$ 9.95
STAR WARS/SPACE MAZE	• SCI-FI GAMES FOR THE APPLE				●	$ 12.95
RENUMBER	• RENUMBER YOUR BASIC PROGRAMS—RENUMBERS EVERYTHING	●			●	$ 14.95
DISK RENUMBER	• SAME AS ABOVE, BUT ON DISK	●				$ 19.95
PILOT 2.0	• THE EDUCATIONAL LANGUAGE. IN MACH. LANG.—INC. EDITOR		●			$ 14.95
PILOT 3.0	• THE DISK VERSION OF THE ABOVE		●			$ 24.95
APPLE TALKER	• YOUR APPLE SPEAKS! NO NEW HARDWARE REQUIRED				●	$ 15.95
APPLE LIS'NER	• SPEECH RECOGNITION THE EASY WAY—GREAT WITH THE TALKER				●	$ 19.95
TIC-TAC-TALKER	• TIC-TAC-TOE USING SPEECH SYNTHESIS AND RECOGNITION				●	$ 19.95
SYSCOP	• MAKE BACKUP TRS-80 SYSTEM TAPES THE EASY WAY		●			$ 9.95
ANDROID NIM-2	• GAME OF NIM WITH ANIMATED ROBOTS AND SOUND		●			$ 14.95
SNAKE EGG	• A BETTING GAME WITH ANIMATED SNAKES AND SOUND		●			$ 14.95
LIFE 2	• 100 GEN. PER MIN. LIFE & BATTLE OF LIFE W/ANIMATION & SOUND		●			$ 14.95
DCV-1	• PUT SYSTEM TAPES ON DISK EVEN IF IN SAME MEM AS DOS		●			$ 9.95
MUSIC MASTER	• ENTER SHEET MUSIC—THE TRS-80 THEN COMPILES & PLAYS IT		●			$ 14.95
DISK MUSIC MASTER	• SAME AS ABOVE BUT ON DISK W/MANY SELECTIONS		●			$ 24.95
TRS-80 CP/M	• OPENS UP THE WHOLE WORLD OF CP/M SOFTWARE TO THE TRS-80		●			$150.00

10% OFF IF YOU ORDER 3 SOFTWARE PACKAGES OR MORE SEND FOR FREE CATALOG—GIVE TYPE OF COMPUTER

TO ORDER BY PHONE OR FOR DEALER INFO—CALL—(617) 682-8131

ADD 75c SHIPPING & HANDLING • MASS. RESIDENTS ADD 5% SALES TAX

MAD HATTER SOFTWARE • 900K SALEM RD • DRACUT, MA 01826

master charge VISA

✓M77

AVAILABLE FROM THESE FINE MICRO COMPUTER DEALERS

CAPITOL COMPUTER SYSTEMS
3396 EL CAMINO AVE
SACRAMENTO CA 95821

TRS-80 SOFTWARE EXCHANGE
17 BRIARCLIFF DR
MILFORD NH 03055

OP AMP TECH BOOKS
1033 N. SYCAMORE AVE
LOS ANGLES CA 90038

COMPUTER CABLEVISION, INC
2617 42ND ST. NW #2
WASHINGTON DC 20007

KENNEDY SYSTEMS
74 BROAD ST.
LYNDONVILLE VT 05851

ADVANCED COMPUTER PRODUCTS
1310B E. EDINGER
SANTA ANA CA 92705

HOBBY WORLD ELECTRONICS
19355 BUSINESS CENTER DR. #6
NORTHRIDGE CA 91324

AUGUST AUTOMATION
28 MILK ST.
WESTBORO MA 01581

THE CPU SHOP
39 PLEASANT ST.
CHARLESTOWN MA 02129

J&J ELECTRONICS LTD
28 COLLINGTON AVE.
BEXHILL-ON-SEA, E. SUSSEX, ENG

COMPUTER VILLAGE
931 SW 87TH AVE
MIAMI FL 33174

L. C. SALES
100 HINCHEY AVE. #705
OTTAWA, ONT., CAN. K1Y4L9

✓ Reader Service—see page 179

Report

Last month, this author created a data-file program for small business. Now he's developed a program to cull the data stored by "Create" and generate financial reports.

Forest E. Myers
5114 Garnett St.
Shawnee KS 66203

In Part 1 we introduced a data file creation program named Create for small businesses. This month we'll develop a program to take the information stored by Create and generate a basic financial report, a statement of income and expense. We use the Report program to generate this summary financial statement.

The program assumes that data files are created on a periodic basis. The sample run assumes that data files are routinely created at the end of each month, although any time period could be used. Additionally, it assumes that the revenue and expense-item codes in Table 1 are used; once again any set of codes can be used.

Introduction

Before going into specifics of the program, let's briefly review several characteristics of the BASIC interpreter (Business Basic by Micro Works of Cincinnati OH) used to write the program. By doing so, it may help your understanding of some of the operations being performed in parts of the program.

First, all input/output of data to mass-storage devices is via string variables. As a consequence, numeric data must be converted to a string to be stored. Conversely, to read in numeric data requires that it be read in as a string and then converted into a numeric value.

Second, when a record is written, 256 bytes are used on the mass-storage device whether the output string has only 1 or 256 bytes. Therefore, you fill as much of the string as possible in input/output operations to avoid wasting storage space.

Third, strings are arrays.

Item Code	Description
400	Revenues—Software
405	Other Revenues
410	Returned Checks
500	Media Expense—Diskettes
510	Media Expense—Tapes
520	Copy Cost
530	Postage—Software
540	Shipping Materials
700	Paper Expense—Computer
710	Office Supplies
720	Computer Software
730	Advertising and Promotion
740	Interest Expense
750	Utilities Expense
760	Insurance Expense
770	Depreciation—Computer
780	Depreciation—Other
790	Rent
800	Bad Debts Expense
810	Travel
820	Other Expense

Table 1. Sample chart of accounts.

```
10  DIM A$(256),B$(10),C$(63),D$(10),r$(72),L$(30)
20  DIM S(30)
30  REM BASIC REQUIRES THAT STRINGS BE INITIALIZED BEFORE USE
40  A$=" " : FOR I=1 TO 8 : A$=A$+A$ : NEXT I
50  F$=A$(1,72)
60  B$=A$(1,10) : D$=B$
70  C$=A$(1,63)
80  L$=A$(1,30)
90  REM C$ HOLDS THE BUSINESS ACCOUNT CODES ( 3 DIGITS IN LENGTH )
100  REM F$ HOLDS NAMES OF FILES USED TO MAKE UP REPORT
110  REM    NOTE: IT IS ASSUMED THAT FILE NAMES ARE 6 CHARACTERS LONG
120  REM          THE SIX CHARACTERS DO NOT INCLUDE THE FILE EXTENSION
130  REM L$ HOLDS USER INPUTED LABEL FOR REPORT
140  C$="400405410500510520530540700710720730740750760770780790800810820"
150  #""
160  FOR I=1 TO 7 : #" " : NEXT I
170  #"               FINANCIAL STATEMENT PROGRAM"
180  #"                  INCOME & EXPENSE REPORT"
190  #"                        VERSION 1.0"
200  #"                          1/3/79"
210  FOR I=1 TO 4 : #" " : NEXT I
220  OPEN (PRINTER,E)
230  INPUT "Enter input device number (0 or 1) ",D
240  IF D<0 OR D>1 THEN 230
250  INPUT "Number of data files in report (12 max) ",F
260  FOR I=1 TO F
270    #"Enter name of file ";I;" ';
280    INPUT " ",F$(I*6-5,I*6)
290    NEXT I
300  #""
310  #"Names of files entered "
320  FOR I=1 TO F
330    #I;". ";F$(I*6-5,I*6)
340    NEXT I
350  INPUT "Any corrections ",D$
360  IF D$<>"Y" THEN 420
370  INPUT "Enter number of file name to be corrected ",I
380  F$(I*6-5,I*6)="      "
390  INPUT "Enter new file name ",F$(I*6-5,I*6)
400  INPUT "Another correction ",D$
410  IF D$="Y" THEN 370
420  INPUT "Enter date label for report ",L$
430  FOR I=1 TO F : REM THIS IS THE FILE LOOP
440    B$=F$(I*6-5,I*6)
450    B$=B$+".DA"+CHR$(0)
460    OPEN (0,E,B$,2,D)
470    GET (0,E,A$,0)
480    REM RECORD ZERO LAYOUT
490    REM  A$(1,3) HOLDS THE NUMBER OF RECORDS IN FILE
500    REM  A$(4,6) THE MAXIMUM NUMBER OF RECORDS THAT CAN BE PUT IN FILE
510    REM  A$(7,44) THE INTERNAL FILE LABEL IS HERE
520    D$=A$(1,3) : REM NUMBER OF RECORDS IN FILE KEPT HERE
530    CONVERT D$ TO N
540    B=INT(N/14) : REM CALCULATE NUMBER OF BLOCKS IN FILE
550    A=N-B*14 : REM SEE IF THERE IS A PARTIAL BLOCK
560    IF A>0 THEN B=B+1 : REM IF PARTIAL BLOCK READ IT TOO
570    #""
580    #"READING FILE    : ";A$(7,44)
590    FOR J=1 TO B : REM BLOCK READ LOOP
600      GET (0,E,A$,J)
610      REM RECORD LAYOUT FOR RECORDS GREATER THAN ZERO
620      REM   POS 1-5  CHECK NUMBER
630      REM   POS 6-7  DEPARTMENT NUMBER
640      REM   POS 8-10 DISTRIBUTION NUMBER
```

Program listing.

Therefore, C$(1,3) refers to elements one through three in string C$ and not row 1, column 3 of a matrix string C$.

Finally, to facilitate the conversion between string and numeric information, the CONVERT function is used. Its equivalents in other BASIC languages are the STR$ and VAL$ commands. With these peculiarities in mind, let's move to the program itself.

Program

Program Report can be broken down into three sections: (1) data file identification and retrieval, (2) arithmetic operations and (3) printed report. By altering the contents of sections 2 and 3, it is possible to generate any desired report.

The data file identification and retrieval section essentially decodes information stored away by program Create. Once entered, it can serve as a "front end" for many business report programs (in this case, it is assumed that the record length is 18 and that records are grouped together in blocks of 14).

The second section of the program performs the arithmetic operations necessary to generate report amounts. In this section of the program, revenue and expense item numbers are taken from string C$ (three digit item codes are assumed).

To change item codes to your own, replace the information in the C$ string. Just make sure your item codes are uniform in length and that you modify the comparison routine (lines 690-710) if your item codes have a length other than three. Additionally, if your BASIC doesn't allow you to address individual items in a string array, you should be able to use LEFT$, MID$ and RIGHT$ commands to get the same result.

The final section of the program prints the report. A variety of methods to get formatted output may be used here. Many BASICs, including Business Basic, have IMAGE and PRINT USING commands.

In the program listing, the formatted field command "%" is used. The "%" indicates a formatted field. The "C" and "$" cause a comma to be printed every third digit to the left of the decimal point and a dollar sign to be placed to the left of the left-most digit of the number printed. The "10F2" portion of the print instruction indicates a print field width of 10 and a floating-point number with two digits to the right of the decimal point.

An income and expense statement generated by the program is shown in the sample run (the company is a fictitious one). It is presented as an example of the type of information that can be generated. The format used is for illustrative purposes only. There is virtually no limit to the way you can output your report. I've chosen this method because it is easiest to code. Some other method may better suit your needs. If so, change it as necessary.

Conclusion

In summary, Create and Report were written as beginnings to a low-cost accounting system for small businesses. The programs are relatively small, flexible and easy to operate. Because they lack a large amount of sophistication, they are relatively easy to understand and modify. Even if they aren't what you need, maybe they will provide you with some ideas for your own accounting system. ■

```
650     REM   POS 11-18 AMOUNT
660     REM THERE ARE 14 RECORDS PER 256 BYTE BLOCK
670     REM THEREFORE NOZERO RECORD FORMAT OCCURS 14 TIMES IN EACH BLOCK
680     FOR K=1 TO 14 : REM RECORDS PER BLOCK LOOP
690       FOR L=1 TO 21 : REM ITEM CODE MATCH UP LOOP
700         IF C$(L*3-2,L*3)=A$(K*18-10,K*18-8) THEN EXIT 730
710         NEXT L
720       GOTO 760 : REM THIS CODE NOT VALID FOR THIS REPORT
730       D$=A$(K*18-7,K*18)
740       CONVERT D$ TO N1
750       S(L)=S(L)+N1
760       NEXT K
770     NEXT J
780   CLOSE (0,E) : REM CLOSE FILE, GO GET ANOTHER IF NEEDED
790   NEXT I
800 REM******** THIS ENDS DATA RETRIEVAL PROCESS  ***************
810 REM******** THIS BEGINS ARITHMETIC PROCESS ******************
820 FOR I=1 TO 21 : S(I)=S(I)*.01 : NEXT I : REM PUT IN DECIMAL
830 T(1)=S(1)+S(2) : REM TOTAL REVENUE
840 T(2)=T(1)-S(3) : REM REVENUE LESS RETURNED CHECKS
850 T(3)=S(4)+S(5)+S(6)+S(7)+S(8) : REM COST OF GOODS SOLD
860 T(4)=T(2)-T(3) : REM GROSS INCOME BEFORE ADMIN AND SELL EXPENSE
870 REM ADD UP SELLING AND ADMINISTRATIVE EXPENSES
880 FOR I=9 TO 21
890   T(5)=T(5)+S(I)
900   NEXT I
910 T(6)=T(4)-T(5) : REM NET INCOME BEFORE TAXES
920 REM******** THIS ENDS THE ARITHMETIC SECTION ***************
930 REM WRITTEN REPORT BEGINS HERE
940 OPEN (PRINTER,E)
950 #"" : REM CLEAR THE SCREEN
960 #"                    CIPHER COMPUTER COMPANY"
970 #"                 Income and Expense Statement"
980 #"                ";L$
990 #"Revenue (software)                ";%C$10F2;S(1)
1000 #"Revenue (other)                  ";%C10F2;S(2)
1010 #" less returned checks            ";%C10F2;S(3)
1020 #"TOTAL REVENUE                                ";%C$10F2;T(2)
1030 #" "
1040 #"Media expense-Diskettes          ";%C10F2;S(4)
1050 #"Media expense-Tapes              ";%C10F2;S(5)
1060 #"Copying cost                     ";%C10F2;S(6)
1070 #"Postage-software                 ";%C10F2;S(7)
1080 #"Shipping-software                ";%C10F2;S(8)
1090 #"COST OF GOODS SOLD                           ";%C10F2;T(3)
1100 #" "
1110 #"Paper expense-computer           ";%C10F2;S(9)
1120 #"Office supplies                  ";%C10F2;S(10)
1130 #"Computer software                ";%C10F2;S(11)
1140 #"Advertising and promotion        ";%C10F2;S(12)
1150 #"Interest expense                 ";%C10F2;S(13)
1160 #"Utilities expense                ";%C10F2;S(14)
1170 #"Insurance expense                ";%C10F2;S(15)
1180 #"Depreciation-computer            ";%C10F2;S(16)
1190 #"Depreciation-other               ";%C10F2;S(17)
1200 #"Rent                             ";%C10F2;S(18)
1210 #"Bad debts expense                ";%C10F2;S(19)
1220 #"Travel                           ";%C10F2;S(20)
1230 #"Other expenses                   ";%C10F2;S(21)
1240 #"TOTAL SELLING AND ADMINISTRATIVE             ";%C10F2;T(5)
1250 #"***  NET INCOME  ***                          ";%C$10F2;T(6)
1260 CLOSE (PRINTER,E)
1270 #"End of processing"
1280 END
```

```
Enter input device number (0 or 1) 1
Number of data files in report (12 max) 1
Enter name of file  1  JAN78B

Names of files entered
 1. JAN78B
Any corrections N
Enter date label for report          JANUARY 1978

READING FILE     : REV & EXP FOR JAN 1978


                    CIPHER COMPUTER COMPANY
                 Income and Expense Statement
                        JANUARY 1978
Revenue (software)                  $477.89
Revenue (other)                      17.50
 less returned checks                10.25
TOTAL REVENUE                                 $485.14

Media expense-Diskettes             35.00
Media expense-Tapes                  1.69
Copying cost                         3.80
Postage-software                     3.00
Shipping-software                   15.00
COST OF GOODS SOLD                                58.49

Paper expense-computer              14.85
Office supplies                      3.00
Computer software                   50.00
Advertising and promotion            6.00
Interest expense                    12.30
Utilities expense                    3.50
Insurance expense                    1.50
Depreciation-computer               37.50
Depreciation-other                   5.25
Rent                                25.00
Bad debts expense                   10.25
Travel                               5.55
Other expenses                       5.00
TOTAL SELLING AND ADMINISTRATIVE                  179.70
***  NET INCOME  ***                             $246.95
```

Sample run.

Haiku Composer

Light lines on dark screen/eyes and hands coordinate/images result.

John Krutch
PO Box 2547
Sepulveda CA 91343

This program composes, with substantial help from a random-number generator, those short poems known as haiku. The haiku originated in Japan about four centuries ago, and today it is the most popular variety of poetry in the world. In its most classical form, the haiku consists of three lines, with five syllables in the first line, seven syllables in the second and five in the third.

Haiku is written in Microsoft's Level II BASIC for the TRS-80. It occupies about 6K. A new poem is composed every time ENTER is pressed; the haiku is printed line by line on the display as it is composed. As you can see from Example 1, Haiku is capable of some rather fanciful imagery in the poems it generates.

How the Program Works

The four haiku patterns beginning at line 400 in the listing form the heart of the program. These patterns, which were extracted from actual poems, are used by the program as a framework for the creation of its own poems.

The program begins by selecting one of the patterns at random. The words the pattern requires are supplied by the word-choosing subroutine, which starts at line 240. If the pattern calls for a first line made up of an article, an adjective and a noun, the word-choosing subroutine will supply one each of these three types of words by taking a word at random from the appropriate group in the vocabulary, which extends from line 2000 to line 2410 in the listing. (This vocabulary, by the way, was selected from two anthologies of haiku.)

Since the line contains an article, control is then transferred to the article-checking subroutine at line 170. If the article is a or an, and it does not agree with the word it precedes, this subroutine changes the article to its proper form. Punctuation is added to the end of the line and the line is printed on the display.

Modern poets who work in this form don't usually limit themselves to the classical 5-7-5 pattern of syllables, and in any case, this procedure is structured to the Japanese language and not particularly suited to English. Accordingly, the poems which Haiku creates are not limited to the 5-7-5 pattern.

Making Changes

If you want to change the vocabulary to make the program compose poems with a different set of words, this is easily accomplished by making the desired additions or deletions to the data lines beginning at 2100. The variables at lines 60, 70, 80 and 90 must also be changed to reflect the current number of words in each category of the vocabulary. Incidentally, line 2010 of the vocabulary contains the article the twice to prevent a disproportionately large number of a's and an's from appearing in the poems.

Occasionally the program will produce a haiku like the one in Example 2, in which the same word is used several times. This will often be of little consequence because the repetition of the word may be meaningful given the context of the poem. Furthermore, the chance that the same word will be chosen more than once in the same poem decreases as the size of the vocabulary increases. But if you want the program to create poems that contain no repetition of words at all, here is a possible solution.

For each haiku, all the values of RAN produced by the word-

```
THE BITTER WITHERED MOUNTAIN;
   UNDER THE QUIET SHAPE
      A SURF FLUTTERS

A DARK FEATHER IS FLOATING;
   THE LINGERING ICY MOON
      THROUGH AN AZURE NIGHT

A SPRING MEADOW . . .
   THE MOON SLEEPS UNDER A BUSH
      BROKEN BLUE SNOWFLAKE

SEA WITH A SHADOW;
   A WHITE WILDFLOWER ON THE MORNING
      SILENT CLOUD
```

Example 1.

```
A LINGERING STILL SILENCE;
   ON THE LINGERING FOREST
      A SILENCE IS FALLING
```

Example 2.

```
1 '         HAIKU, VERS  1 1
2 '         BY JOHN KRUTCH
10 RANDOM
20 CLEAR 200
30 DEFSTR B,L,W
40 DEFINT A-I,N,P,R,V
50 ARTNMB=4
60 ADJNMB=50
70 NOUNNMB=50
80 VERBNMB=13
90 PREPNMB=7
100 GOTO 140
110 LIN=""
120 RESTORE
130 A$=INKEY$ IF A$=CHR$(13) THEN 140 ELSE 130
140 CLS
150 RAN=RND(4)
160 ON RAN GOTO 400, 700, 1000, 1300
165 '          ARTICLE-CHECKING SUBROUTINE
166 '          THIS SUBROUTINE SCANS THROUGH THE LINE OF VERSE
167 '          JUST COMPOSED.  IF IT FINDS "A" BEFORE A VOWEL,
168 '          OR "AN" BEFORE A CONSONANT, IT CONVERTS THE
169 '          ARTICLE TO ITS PROPER FORM
170 FOR I=1 TO LEN(LIN) - 2
180 IF MID$(LIN,I,3)=" A " THEN B=MID$(LIN,I+3,1) IF B="A" OR
    B="E" OR B="I" OR B="O" OR B="U" THEN LIN=LEFT$(LIN,I+1) +  "N" + MID$(LIN,I+2)
190 NEXT I
200 FOR I=1 TO LEN(LIN) - 2
210 IF MID$(LIN,I,4)=" AN " THEN B=MID$(LIN,I+4,1) IF B="A" OR
    B="E" OR B="I" OR B="O" OR B="U" THEN 220 ELSE  LIN=LEFT$(LIN,I+1) + MID$(LIN,I+3)
220 NEXT I
230 RETURN
232 '          WORD-CHOOSING SUBROUTINE
233 '          THE VARIABLE P IS A POINTER WHICH IS SET TO THE
234 '          BEGINNING OF THE GROUP OF WORDS INDICATED BY
235 '          THE REQUIREMENTS OF THE PARTICULAR HAIKU
236 '          PATTERN IN USE.  WITH THE HELP OF THE RANDOM
237 '          NUMBER RAN A WORD IS THEN CHOSEN AT RANDOM
238 '          FROM THIS GROUP.
240 RAN=RND(N) + P
250 FOR I=1 TO RAN
260 READ WRD
270 NEXT I
280 LIN=LIN + " " + WRD
290 RESTORE
300 RETURN
395 '          FIRST HAIKU PATTERN
400 N=ARTNMB: P=0: GOSUB 240     ' 240 IS WORD-CHOOSING SUBR
410 N=ADJNMB: P=ARTNMB: GOSUB 240
420 N=NOUNNMB: P=ARTNMB + ADJNMB: GOSUB 240
430 GOSUB 170     ' 170 IS ARTICLE-CHECKING SUBROUTINE
440 LIN=LIN + "  "
450 PRINT@ 340, LIN
460 LIN=""
470 N=ARTNMB: P=0: GOSUB 240
480 N=NOUNNMB: P=ARTNMB + ADJNMB: GOSUB 240
490 N=VERBNMB: P=ARTNMB + ADJNMB + NOUNNMB: GOSUB 240
500 N=PREPNMB: P=ARTNMB + ADJNMB + NOUNNMB + VERBNMB:GOSUB 240
510 N=ARTNMB: P=0: GOSUB 240
520 N=NOUNNMB: P=ARTNMB + ADJNMB: GOSUB 240
530 GOSUB 170
540 PRINT@ 406, LIN
550 LIN=""
560 N=ADJNMB: P=ARTNMB: GOSUB 240
570 GOSUB 240
580 N=NOUNNMB: P=ARTNMB + ADJNMB: GOSUB 240
590 PRINT@ 472, LIN
600 GOTO 110
695 '          SECOND HAIKU PATTERN
700 N=NOUNNMB: P=ARTNMB + ADJNMB: GOSUB 240     '240 IS WORD-CHOOSING SUBROUTINE
710 N=PREPNMB: P=ARTNMB + ADJNMB + NOUNNMB + VERBNMB:GOSUB 240
720 N=ARTNMB: P=0: GOSUB 240
730 N=NOUNNMB: P=ARTNMB + ADJNMB: GOSUB 240
740 GOSUB 170     ' 170 IS ARTICLE-CHECKING SUBROUTINE
750 LIN=LIN + ","
760 PRINT@ 340, LIN
770 LIN=""
780 N=ARTNMB: P=0: GOSUB 240
790 N=ADJNMB: P=ARTNMB: GOSUB 240
800 N=NOUNNMB: P=ARTNMB + ADJNMB: GOSUB 240
810 N=PREPNMB: P=ARTNMB + ADJNMB + NOUNNMB + VERBNMB:GOSUB 240
820 N=ARTNMB: P=0: GOSUB 240
830 N=NOUNNMB: P=ARTNMB + ADJNMB: GOSUB 240
840 GOSUB 170
850 PRINT@ 406, LIN
860 LIN=""
870 N=ADJNMB: P=ARTNMB: GOSUB 240
880 N=NOUNNMB: P=ARTNMB + ADJNMB: GOSUB 240
890 PRINT@ 472, LIN
900 GOTO 110
995 '          THIRD HAIKU PATTERN
1000 N=ARTNMB: P=0: GOSUB 240      240 IS WORD-CHOOSING SUBR
1010 N=ADJNMB: P=ARTNMB: GOSUB 240
1020 GOSUB 240
1030 N=NOUNNMB: P=ARTNMB + ADJNMB: GOSUB 240
1040 GOSUB 170      ' 170 IS ARTICLE-CHECKING SUBR
1050 LIN=LIN + ";"
1060 PRINT@ 340, LIN
1070 LIN=""
1080 N=PREPNMB: P=ARTNMB + ADJNMB + NOUNNMB + VERBNMB:GOSUB 240
1090 N=ARTNMB: P=0: GOSUB 240
1100 N=ADJNMB: P=ARTNMB: GOSUB 240
1110 N=NOUNNMB: P=ARTNMB + ADJNMB: GOSUB 240
1120 GOSUB 170
1130 PRINT@ 406, LIN
1140 LIN=""
1150 N=ARTNMB: P=0: GOSUB 240
1160 N=NOUNNMB: P=ARTNMB + ADJNMB: GOSUB 240
1170 N=VERBNMB: P=ARTNMB + ADJNMB + NOUNNMB: GOSUB 240
1180 GOSUB 170
1190 PRINT@ 472, LIN
1200 GOTO 110
1295 '          FOURTH HAIKU PATTERN
1300 N=ARTNMB: P=0: GOSUB 240      ' 240 IS WORD-CHOOSING SUBR
1310 N=ADJNMB: P=ARTNMB: GOSUB 240
1320 N=NOUNNMB: P=ARTNMB + ADJNMB: GOSUB 240
1330 N=VERBNMB: P=ARTNMB + ADJNMB + NOUNNMB: GOSUB 240
1340 GOSUB 170      ' 170 IS ARTICLE-CHECKING SUBROUTINE
1350 LIN=LIN + ";"
1360 PRINT@ 340, LIN
1370 LIN=""
1380 N=ARTNMB: P=0: GOSUB 240
1390 N=ADJNMB: P=ARTNMB: GOSUB 240
1400 GOSUB 240
1410 N=NOUNNMB: P=ARTNMB + ADJNMB: GOSUB 240
1420 GOSUB 170
1430 PRINT@ 406, LIN
1440 LIN=""
1450 N=PREPNMB: P=ARTNMB+ADJNMB+NOUNNMB+VERBNMB: GOSUB 240
1460 N=ARTNMB: P=0: GOSUB 240
1470 N=ADJNMB: P=ARTNMB: GOSUB 240
1480 N=NOUNNMB: P=ARTNMB + ADJNMB: GOSUB 240
1490 GOSUB 170
1500 PRINT@ 472, LIN
1510 GOTO 110
2000 '          ARTICLES
2010 DATA "A","THE","AN","THE"
2100 '          ADJECTIVES
2110 DATA "AUTUMN","HIDDEN","BITTER","MISTY","SILENT","EMPTY"
2120 DATA "DRY","DARK","SUMMER","ICY","DELICATE","QUIET"
2130 DATA "WHITE","SUDDEN","COOL","SPRING","WINTER","DAPPLED"
2140 DATA "TWILIGHT","DAWN","CRIMSON","WISPY","AZURE"
2150 DATA "BLUE","BILLOWING","BROKEN","COLD","DAMP","FALLING"
2160 DATA "FROSTY","GREEN","LONG","LATE","LINGERING","LIMPID"
2170 DATA "LITTLE","MORNING","MUDDY","ORANGE","OLD","RED"
2180 DATA "STILL","SMALL","SPARKLING","THROBBING","WANDERING"
2190 DATA "WITHERED","WILD","BLACK","YOUNG"
2200 '          NOUNS
2210 DATA "SCARECROW","WATERFALL","RIVER","BREEZE","MOON"
2220 DATA "RAIN","WIND","SEA","MORNING","SNOW","LAKE","SUNSET"
2230 DATA "PINE","SHADOW","LEAF","DAWN","GLITTER","FOREST"
2240 DATA "HILL","CLOUD","MEADOW","SUN","GLADE","BIRD"
2250 DATA "BUTTERFLY","BUSH","CROW","DEW","DUST","FIELD"
2260 DATA "FLOWER","FIREFLY","FEATHER","GRASS","MOUNTAIN"
2270 DATA "NIGHT","POND","PINE-CONE","SHADE","SNOWFLAKE"
2280 DATA "SILENCE","SOUND","SKY","SHAPE","SURF","THUNDER"
2290 DATA "VIOLET","WATER","WILDFLOWER","WAVE"
2300 '          VERBS
2310 DATA "SHAKES","DRIFTS","HAS TURNED","STRUGGLES"
2320 DATA "HAS FALLEN","HAS PASSED","SLEEPS","CREEPS"
2330 DATA "FLUTTERS","HAS RISEN","IS FALLING","IS TRICKLING"
2340 DATA "IS FLOATING"
2400 '          PREPOSITIONS
2410 DATA "ON","IN","WITH","OF","THROUGH","BEHIND","UNDER"
2420 END
```

Thanks to Radio Shack manager Dan Donaldson of Santa Monica for letting me borrow his line printer to make the listing reproduced in this article.

Program listing.

choosing subroutine should be stored. (RAN is the variable that points to the next word to be incorporated into the haiku.) Then, whenever the word-choosing subroutine comes up with a new value for RAN, it is compared to the values in memory. If the new value is the same as any of the old values, instead of incorporating the associated word into the poem, the word-choosing subroutine is called again. Exception has to be made for RAN ⩽ 4, since these four values refer to the articles a, an and the.

A more serious problem, semantics, is illustrated by Example 3. Although the poet has a great amount of latitude when writing poetry and is free to position words and phrases in unfamiliar and sometimes strikingly unusual ways (which is why a poetry-composing program based on a random-number generator such as this one is bound to be so much more successful than a similar program to, say, write short stories!)—nevertheless, even granting the program a certain freedom from ordinary restrictions of language, the phrase "breeze of the shape" is clearly meaningless (not to mention the second and third lines in the example.

BREEZE OF THE SHAPE;
A RED NIGHT UNDER THE SUN
WILD SCARECROW

Example 3.

Someone with a lot of patience might try matching every word in the vocabulary with every other word and categorizing the result, so that the program would never be allowed to choose shape as the object of the preposition of. But this really isn't fair; this is like giving the poem to the program already half-written. This problem won't be solved until programs are written that demonstrate creativity and an ability to understand natural language—in other words, until we have intelligent computers.

Conclusion

While I seriously doubt that this program will displace such great Japanese masters of haiku as Bashō and Issa, it nevertheless produces some interesting poetry. The more care that's taken with assembling the vocabulary, the better (and more pertinent) the haiku will be.

If you don't feel like typing in the whole program and you have a Level II TRS-80 with at least 16K RAM, a cassette version of Haiku is available from Omicron Software, PO Box 2547, Sepulveda CA 91343, for $8.50.■

✓ *Reader Service—see page 179*

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD
FIRST CLASS PERMIT NO. 17 PETERBOROUGH NH 03458

POSTAGE WILL BE PAID BY ADDRESSEE

kilobaud
MICROCOMPUTING T.M.

Subscription Department • Box 997
Farmingdale NY 11737

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD
FIRST CLASS PERMIT NO. 17 PETERBOROUGH NH 03458

POSTAGE WILL BE PAID BY ADDRESSEE

kilobaud
MICROCOMPUTING T.M.

Subscription Department • Box 997
Farmingdale NY 11737

The Sorcerer Connection

This follow-up article to "What's so Magic about the Sorcerer?" (June 1979 issue, p. 100) shows how to use the parallel port to connect the Sorcerer to a model 33 Teletype.

Ken Barbier
Borrego Engineering
PO Box 1253
Borrego Springs CA 92004

In the June 1979 *Kilobaud MICROCOMPUTING* (p. 100) we examined in detail the interfacing requirements of the Exidy Sorcerer computer's parallel input/output (I/O) port. This article presents an example of how to use that parallel port: to connect the computer to a model 33 Teletype machine (TTY).

The Sorcerer I/O port is already compatible with a number of printers that accept 8-bit parallel data, but the ubiquitous TTY communicates over a 20 mA loop at 110 baud. Neither of these requirements is met by the Sorcerer's array of interfacing capabilities, so the circuit described here provides the necessary format conversions.

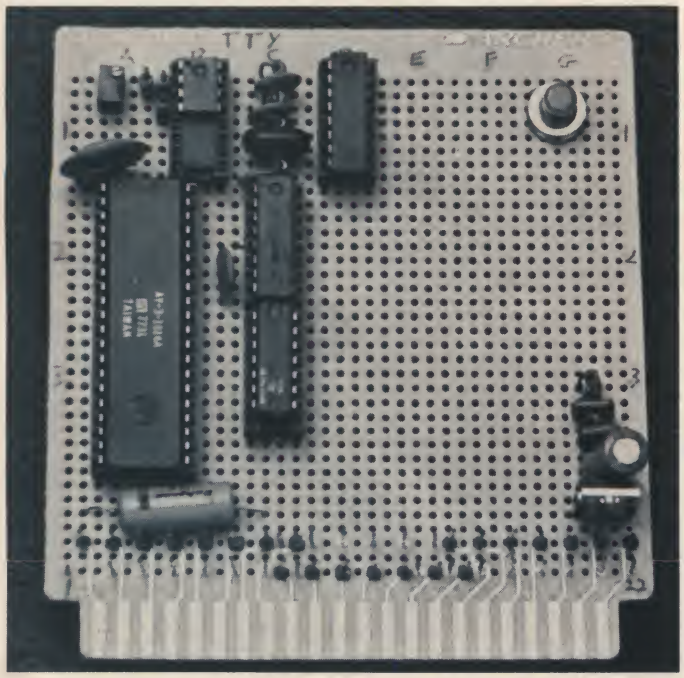
Why a TTY?

About the only excuse for hanging a slow, noisy old Teletype on a shiny new computer is "because it is there." Almost every computer hobbyist seems to own one. Also, TTYs are relatively inexpensive, incredibly reliable (that should provoke some arguments!) and great fun to try to fix on a rainy day.

Not too long ago I didn't care much for the machine's reliability. I thought I was an expert, having spent years trying to make them work right. That was before I discovered that a properly adjusted and lubricated TTY will print yards of paper and read or punch miles of paper tape without error. This information won't do you much good if you don't know any TTY repair geniuses, so if you do find one of this rare breed, be nice to him.

The TTY Connection

TTYs are there, just about everywhere you look, like cacti in Texas. If you have access to one and want to hang it onto your Sorcerer's parallel port, the schematic in Fig. 1 shows the circuit you will need to use it as a printer. Fig. 2 shows the connections for the other direction of transmission, allowing



The Sorcerer-to-Teletype interface circuit board. The circuit is wire-wrapped on a Radio Shack Experimenter's Breadboard.

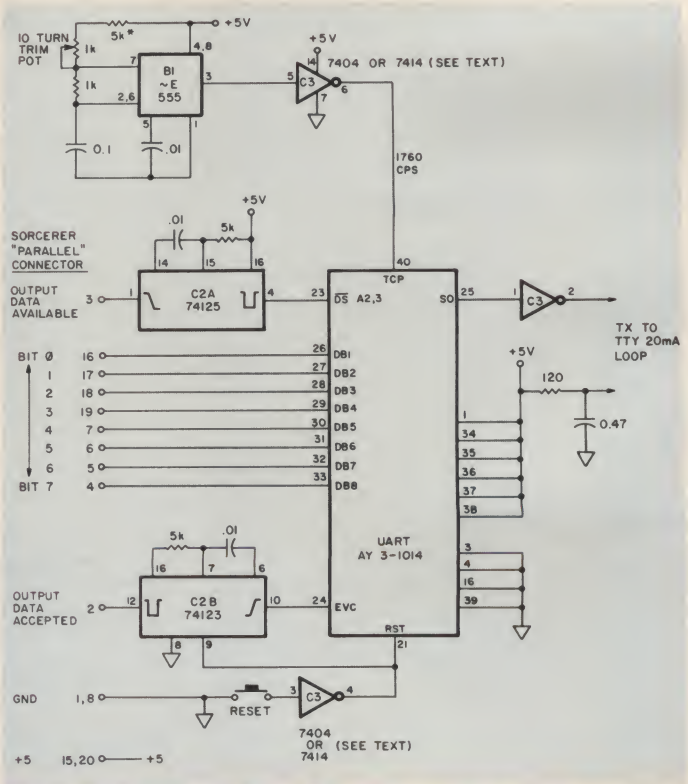


Fig. 1. The schematic diagram of the Sorcerer parallel port to 20 mA current loop interface. This circuit will provide transmission to the Teletype, allowing its use as a printer.

you to use the TTY keyboard or tape reader as input to the computer.

The only drawback of this circuit is that it requires a −12 V dc supply, and the Sorcerer does not have this voltage available on the back-panel connector. So if you need the input capability you will have to provide −12 volts at .02 Amps.

The photo of the circuit as built on an experimenter's breadboard (from Radio Shack) shows the parts layout as referenced in the schematics. Location A1 is in the upper left corner. The Sorcerer-to-TTY send (TX) and receive (RX) circuits both fit on half the board. The board plugs into an edge connector that can be mounted inside an appropriately sized cabinet. Power is provided by the computer's +5 V supply, accessible through the parallel-port connector.

The photo with model shows the interface board plugged into its edge connector and the cables that connect to the I/O port and to the TTY.

The circuit uses an NE 555 oscillator to provide both TX and RX clocks. You might have to select the value of the resistor marked 5k* to provide the correct 1760 Hz clock when the trimpot is in the center of its range under normal conditions. This oscillator is somewhat temperature sensitive, so the 1k trimmer is included in case drift of component values requires fine tuning of the clock rate.

The universal asynchronous receiver/transmitter (UART) used is the AY 3-1014, which operates from a single-supply voltage. It is often erroneously listed in the catalogs as AY 5-1014, since it replaces the earlier AY 5-1013, which needs two supply voltages. At times I have ordered it under this incorrect part number, since that number appeared in the catalog, and have always gotten the right part with the right number. Clear?

The other ICs on the board are 74123 one-shots and a hex inverter that can be a 7404 if the receive circuit is not going to be used. If the receive circuit is included, the IC in location C3 will have to be a 7414 instead of 7404. The 7414 has a Schmitt trigger input stage that is only required for the 20 mA loop input circuit.

The one-shots are used to produce narrow strobes, which the UART is happier with than the logic-low signals produced by the Sorcerer parallel-port handshake circuit. Their inclusion in this interface prevents any possible hang-ups of the handshake flip-flops in the computer.

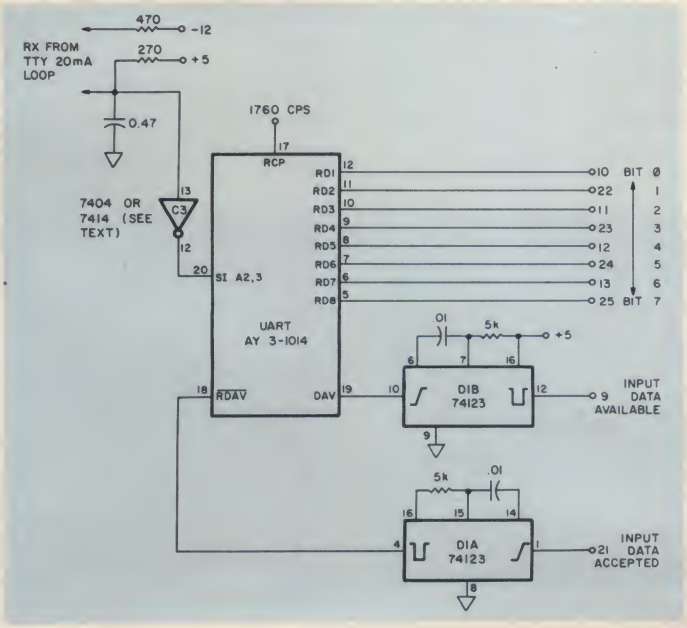


Fig. 2. The additional circuitry necessary to allow use of the Teletype as an input device for the computer. This part of the interface is optional.

The interface board with the cables that connect to the computer and to the TTY through the 4-pin Jones plug.

Testing, Testing, Testing . . .

With the TTY interface completed, you should run an ohmmeter check to ensure that there are no shorts between any of the pins on the DB-25 P connector. Connect the interface to the Sorcerer, turn on the power and press the UART RESET switch. This will initialize all the circuitry within the UART and will clear the Sorcerer's handshake flip-flops.

The TTY test program is written in the BASIC language supplied with the Sorcerer. It addresses the TTY through the parallel-port address of 255 decimal. This test routine will

```
10 PRINT "SORCERER TTY TEST  11 FEB 79"
20 GOSUB 300
30 FOR I=65 TO 96
40 X=I:GOSUB 200
50 NEXT
60 FOR I=33 TO 64
70 X=I:GOSUB 200
80 NEXT
90 X=32:GOSUB 200
100 FOR I=1 TO 5
110 X=255:GOSUB 200
120 NEXT
130 GOTO 20
200 OUT 255,X:GOSUB 400
210 RETURN
300 OUT 255,13:GOSUB 400:OUT 255,10:GOSUB 400
310 RETURN
400 FOR K=1 TO 60:NEXT:RETURN
```

The BASIC-language Teletype-printer test routine. This program will print lines containing all letters, numbers and punctuation marks.

print a line consisting of each letter, number and punctuation mark, followed by five rubouts that should not print on the TTY.

If you don't have access to an oscilloscope or counter to set the frequency of the 1760 Hz UART clock, you can run the test program while slowly adjusting the 1k trimmer. With any luck you will end up with the TTY printing the test lines as shown in Fig. 3.

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑←@!"#$%&'()*+,-./0123456789:;<=>?@
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑←@!"#$%&'()*+,-./0123456789:;<=>?@
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑←@!"#$%&'()*+,-./0123456789:;<=>?@
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑←@!"#$%&'()*+,-./0123456789:;<=>?@
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑←@!"#$%&'()*+,-./0123456789:;<=>?@
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑←@!"#$%&'()*+,-./0123456789:;<=>?@
```

Fig. 3. The printer output resulting from the test program of the test routine. Printing will continue until interrupted from the keyboard.

Teletype Operation

The TTY interface can now be used in either of two modes. As in the test program, it can be addressed by a BASIC-language OUT 255,xx statement, where xx is the desired character code in decimal ASCII, as listed in the Sorcerer's manual. Since the TTY is such a slow device, you will need to delay between the output of one character and the next. The delay subroutine in line 300 of the test program will slow the Sorcerer down to a baud rate compatible with the TTY.

The Monitor program supplied with the computer can also be used to access a printer connected to the parallel port. To reassign the output device from the CRT screen to the TTY interface, exit to the Monitor with the BASIC statement BYE. When the Monitor prompts with the greater than (>) character on the screen, type in SET S = 20. This will set the output-device speed to a rate compatible with the TTY's ten characters per second. Now enter SET O = P, and the Monitor should stop writing on the screen and write to the TTY instead. A Monitor command of PP will return you to BASIC, which will now also output to the TTY instead of the screen. This way you can print out BASIC program listings. ■

Instant Software™ New Releases

Math? Model Rocketry? TRS-80* Utilities? There's something for everyone in this batch of new releases . . . which ones have *you* been waiting for?

Ask for Instant Software at your local computer store, use the handy order blank on page 89, or just get out your credit card and call Toll Free 1-800-258-5473.

TRS-80*

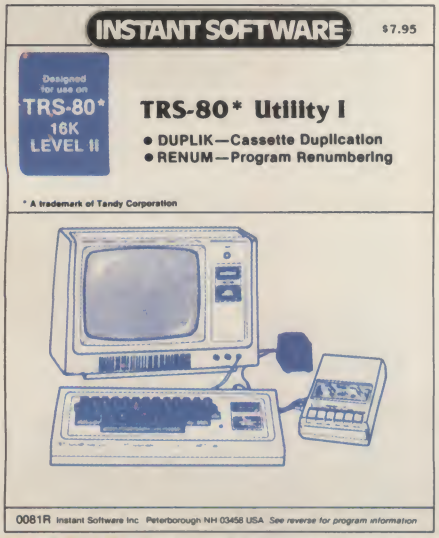
Level II

FINANCIAL ASSISTANT Compute the figures for a wide variety of business needs. Included are:
- **Depreciation**—This program lets you figure depreciation on equipment in five different ways.
- **Loan Amortization Schedule**—Merely enter a few essential factors, and your TRS-80 will display a complete breakdown of all costs and schedules of payment for any loan.
- **Financier**—This program performs thirteen common financial calculations. Easily handles calculations on investments, depreciation, and loans.
- **1% Forecasting**—Use this simple program to forecast sales, expenses, or any other historical data series.

All you need is a TRS-80 Level II 16K. **Order No. 0072R $7.95**

TRS-80 UTILITY 1 Ever wonder how some programmers give their programs that professional look? Instant Software has the answer with the TRS-80 Utility 1 package. Included are:
- **RENUM**—Now you can easily renumber any Level II program to make room for modification, or to clean up the listing.
- **DUPLIK**—This program will let you duplicate any BASIC, assembler, or machine-language program, verify the data, merge two or more programs into one data block, and even copy Level I programs on a Level II machine.

For TRS-80 Level II 16K. **Order No. 0081R $7.95.**



TRS-80 UTILITY 2 Let Instant Software change the drudgery of editing your programs into a quick, easy job. Included in this package are:
- **CFETCH**—Search through any Level II program tape and get the file names for all the programs. You can also merge BASIC programs, with consecutive line numbers, into one program.
- **CWRITE**—Combine subroutines, that work in different memory locations into one program. This works with BASIC or machine-language programs and gives you a general checksum.

This package is just the thing for your TRS-80 Level II 16K. **Order No. 0076R $7.95**

HOUSEHOLD ACCOUNTANT Let your TRS-80 help you out with many of your daily household calculations. Save time and money with these fine programs:
- **Budget and Expense Analysis**—You can change budgeting into a more pleasant job with this program. With nine sections for income and expenses and the option for one- and three-month review or year totals, you can see where your money is going.
- **Life Insurance Cost Comparison**—Compare the cost of various life insurance policies. Find out the difference in price between term and whole life. This program can store and display up to six different results.
- **Datebook**—Record all those important dates in your life for fast, easy access. The program has all major holidays already included.

All you need is TRS-80 Level II 16K. **Order No. 0069R $7.95**

MODEL ROCKET ANALYZER AND PRE-FLIGHT CHECK Let your TRS-80 help you enjoy the fast-growing hobby of model rocketry. The complementary programs included are:
- **Model Rocket Flight History Prediction**—This program will compute the flight characteristics for almost any model rocket. Engine and body tube data included covers Estes, Centuri, Flight Systems, A.V.I. Astroport, C.M.R., and Kopter products.
- **Weather Forecaster**—Before you launch your rocket, get an up-to-the-minute weather forecast. Just enter your location, elevation, average temperatures for January and July, and barometric pressure. You'll be the short-range weather forecaster for your local area.

For a successful launch, you'll need TRS-80 Level II 16K. **Order No. 0024R $7.95**

TEACHER Now you can have the benefits of computer-assisted instruction right in your own home. The programs allow you to input any number of questions and answers. Using this data, the computer will prepare several types of tests, quiz students, provide up to three "hints" per question—even offer graphic rewards for younger children, all at the user's discretion. Perfect for parents, teachers, or anyone faced with learning a lot of material in the shortest possible time. Furnished with blank data cassette.

Teacher requires a 16K Level II TRS-80. **Order No. 0065R $9.95.**

PET**

TURF AND TARGET Whether on the field or in the air, you'll have fun with Turf and Target package. Included are:
- **Quarterback**—You're the quarterback as you try to get the pigskin over the goal line. You can pass, punt, hand off, and see the results of your play using the PET's superb graphics.
- **Soccer II**—Play the fast-action game of soccer with four playing options. The computer can play itself, play a single player, two players with computer assistance, and two players without help.
- **Shoot**—You're the hunter as you try to shoot the bird out of the air. The PET will keep score.
- **Target**—Use the numeric keypad to shoot your puck into the home position as fast as you can.

To run and score all you'll need is a PET with 8K. **Order No. 0097P $7.95**

ARCADE I This package combines an exciting outdoors sport with one of America's most popular Indoor sports:
- **Kite Fight**—It's a national sport in India. After you and a friend have spent several hours maneuvering your kites across the screen of your PET, you'll know why!
- **Pinball**—By far the finest use of the PET's exceptional graphics capabilities we've ever seen, and a heck of a lot of fun to play to boot.

Requires an 8K PET. **Order No. 0074R $7.95.**

ARCADE II One challenging memory game and two fast-paced action games make this one package the whole family will enjoy for some time to come. Package includes:
- **UFO**—Catch the elusive UFO before it hits the ground!
- **Hit**—Better than a skeet shoot. The target remains stationary, but you're moving all over the place.
- **Blockade**—A two-player game that combines strategy and fast reflexes.

Requires 8K PET. **Order No. 0045P $7.95.**

Apple***

MATH TUTOR I Parents, teachers, students, now you can turn your Apple computer into a mathematics tutor. Your children or students can begin to enjoy their math lessons with these programs:
- **Hanging**—Perfect your skill with decimal numbers while you try to cheat the hangman.
- **Spellbinder**—Cast spells against a competing magician as you practice working with fractions.
- **Whole Space**—While you exercise your skill at using whole numbers, your ship attacks the enemy planet and destroys alien spacecraft.

All programs have varying levels of difficulty. All you need is Applesoft II with your Apple II 24K. **Order No. 0073A $7.95**

MATH TUTOR II Your Apple computer can go beyond game playing and become a mathematics tutor for your children. Using the technique of immediate positive reinforcement, you can make math fun with:
- **Car Jump**—Reinforce the concept of calculating area while having fun making your car jump over the ramps.
- **Robot Duel**—Practice figuring volumes of various containers while your robot fights against the computer's mechanical man.
- **Sub Attack**—Take the mystery out of working with percentages as your submarine sneaks into the harbor and destroys the enemy fleet.

All you need is Applesoft II with your Apple II and 20K. **Order No. 0098A $7.95.**

*A trademark of Tandy Corporation
**A trademark of Apple Computer Inc.
***A trademark of Commodore Business Machines Inc.

Instant Software™ Has It All...

TRS-80*

Level I

KNIGHT'S QUEST/ROBOT CHASE/HORSE RACE This varied package of one-player games will give you hours of fun.
- **Knight's Quest**—Battle demons to gain treasure and become a full-fledged knight.
- **Robot Chase**—Destroy the deadly robots without electrocuting yourself.
- **Horse Race**—Place your bet and cheer your horse to the finish line.

These programs require a TRS-80 Level I 16K. **Order No. 0003R $7.95.**

SPACE TREK III Let yourself go to the far ends of the solar system—and beyond. This package includes:
- **Stellar Wars**—Shoot down the Tie fighters and destroy the Death Star.
- **Planetary Lander**—Land your spacecraft and plant your flag across the solar system.

These one-player games require a TRS-80 Level I 4K. **Order No. 0031R $7.95.**

DESTROY ALL SUBS/GUNBOATS/BOMBER This package of three programs is fun for the whole family. Included are:
- **Destroy All Subs**—Hunt down enemy subs while avoiding mines and torpedoes. A one-player game.
- **Gunboats**—One or two players can try to blow each others ships out of the water.
- **Bomber**—Carefully release your bomb to destroy the moving submarine. A one-player game.

To enjoy these programs, you'll need a TRS-80 Level I 4K. **Order No. 0021R $7.95.**

FUN PACKAGE I Why call it "Fun Package?" Judge for yourself! This entertaining package includes:
- **Rocket Pilot**—Flying it is easy—it's the landing that's tough!
- **Paper, Rock, Scissors**—It's the time-honored game just as you remember it played against your TRS-80.
- **Hex I**—Just when you master this puzzle game, the computer will increase the difficulty.
- **Missile Attack**—Use your missiles to protect your city from jet attack.

Requires a Level I 16K TRS-80. **Order No. 0037R $7.95.**

DOODLES AND DISPLAYS I Here's a mixed bag of programs that's sure to entertain:
- **Doodle Pad**—Draw pictures and save them on cassette tapes.
- **Symmetrics**—Turn your TRS-80 into a kaleidoscope.
- **Video Display**—Follow the bouncing cursor as your TRS-80 draws its own pictures.
- **Math Curves**—Bring those Geometry lessons to life as the computer draws six different geometrical curves.
- **Rug Patterns**—A never ending stream of symmetrical patterns that's sure to spark your imagination.

All you'll need is a 16K Level I TRS-80. **Order No. 0030R $7.95.**

BUSINESS PACKAGE I Keep the books for a small business with your TRS-80 Level I 4K. The six programs included are:
- **General Information**—The instructions for using the package.
- **Fixed Asset Control**—This will give you a list of your fixed assets and term depreciation.
- **Detail Input**—This program lets you create and record your general ledger on tape for fast access.
- **Month and Year to Date Merge**—This program will take your monthly ledger data and give you a year to date ledger.
- **Profit and Loss**—With this program you can quickly get trial balance and profit and loss statements.
- **Year End Balance**—This program will combine all your data from the profit and loss statements into a year end balance sheet.

With this package, you can make your TRS-80 a working partner. **Order No. 0013R $29.95.**

BUSINESS PACKAGE III This package can change your TRS-80 into a full working partner for any businessman:
- **Inventory**—Maintain a computer based inventory for a constant inventory system.
- **Discount and Commission Percentages**—Let your computer figure out mark up and discount calculations, sales tax and more. This is a perfect time saving package for any small business.

For the TRS-80 Level I 4K. **Order No. 0061R $7.95.**

CAVE EXPLORING/YACHT/MEMORY These three programs are not only fun, but stimulating as well:
- **Cave Exploring**—Search for fabulous treasures as you explore the magic cave. For one player.
- **Yacht**—A two player game of strategy and chance. The computer rolls the dice and keeps score.
- **Memory**—Two players can pit their memories in this program based on a popular television show. You'll need a TRS-80 with Level I and 16K. **Order No. 0010R $7.95.**

CAR RACE/RAT TRAP/ANTIAIRCRAFT Enjoy these challenging, fun-filled programs:
- **Car Race**—You and a friend can race on a choice of two tracks.
- **Rat Trap**—Trap the rat in his maze with your two cats. For one player.
- **Antiaircraft**—Aim and shoot down the enemy airplane. Requires Level I 4K TRS-80. **Order No. 0011R $7.95.**

STATUS OF HOMES/AUTO EXPENSES Two long-awaited programs that have got to save you money at work or in the home:
- **Status of Homes**—This program will allow you to keep track of all the expenses involved in building one house or an entire subdivision.
- **Auto Expenses**—Find out *exactly* what it costs you to drive your car or truck.

These programs require a TRS-80 Level I 4K. **Order No. 0012R $7.95.**

HEX PAWN/SHUTTLE CRAFT DOCKING/SPACE CHASE/SEA BATTLE This four-game package is sure to provide hours of fun for the whole family.
- **Hex Pawn**—Turn your TRS-80 into a model of artificial intelligence by playing a simple game.
- **Shuttle Craft Docking**—Land your shuttle craft on the starship—even through varying gravity fields!
- **Space Chase**—Seek out and destroy the enemy delta that's hidden in the star field.
- **Sea Battle**—You must find and destroy the enemy fleet.

This package requires a TRS-80 Level I 16K. **Order No. 0041R $7.95.**

DEMO I This package is just the thing to show your friends what your TRS-80 can do. Included are:
- **Computer Composer**—Compose and play music using only a standard AM radio.
- **Horse Race**—Place your bet and cheer your pony to the winner's circle.
- **E.S.P.** Test your powers of extrasensory perception.
- **HI-Lo/Tic-Tac-Toe**—Guess the secret number or get three in a row.
- **Petals Around the Rose**—Can you figure out the secret behind the five dice?
- **Slot Machine**—Turn your computer into a one-armed bandit. These programs require a TRS-80 Level I 4K. **Order No. 0020R $7.95.**

PERSONAL FINANCE I Let your TRS-80 handle all the tedious details the next time you figure your finances:
- **Personal Finance I**—With this program you can control your incoming and outgoing expenses.
- **Checkbook**—Your TRS-80 can balance your checkbook and keep a detailed list of expenses for tax time.

This handy financial control package for the home requires only a TRS-80 Level I 4K. **Order No. 0027R $7.95.**

Level II

SPACE TREK IV Trade or wage war on a planetary scale. This package includes:
- **Stellar Wars**—Engage and destroy Tie fighters in your attack on the Death Star. For one player.
- **Population Simulation**—A two-player game where you control the economy of two neighboring planets.

You decide, guns or butter, with your TRS-80 Level II 16K. **Order No. 0034R $7.95.**

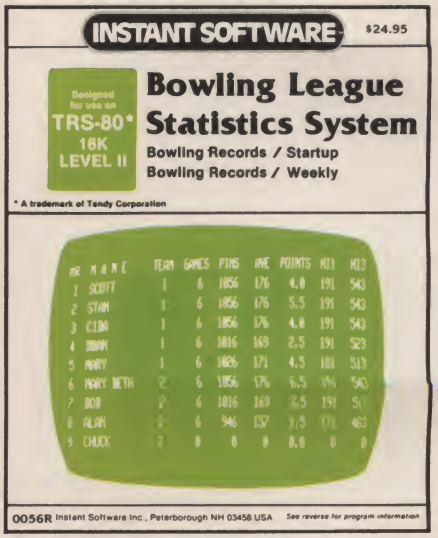
DOODLES AND DISPLAYS II Wait until your children get a hold of this package:
- **Doodle Pad**—Draw pictures and save them on cassette tapes.
- **Symmetrics**—An electric kaleidoscope that changes from black to white and back again. It's almost hypnotic!
- **Drawing**—like Doodle Pad, but for the serious artist. Over 40 user commands!
- **Random Pattern Display**—The computer does the drawing, but those with itchy fingers can tamper.
- **Math Curves**—Bring those Geometry lessons to life. Six different geometrical curves on the screen of your TRS-80.
- **Rug Patterns**—Yes, it does design rug patterns and, with a choice of user or computer control, it can do a whole lot more.

For the Level II 16K TRS-80. **Order No. 0042R $7.95.**

RAMROM PATROL/TIE FIGHTER/KLINGON CAPTURE Buck Rogers never had it so good. Engage in extraterrestrial warfare with:
- **Ramrom Patrol**—Destroy the Ramron ships before they capture you.
- **Tie Fighter**—Destroy the enemy Tie fighters and become a hero of the rebellion.
- **Klingon Capture**—You must capture the Klingon ship intact. It's you and your TRS-80 Level II 16K battling across the galaxy. **Order No. 0028R $7.95.**

CARDS This one-player package will let you play cards with your TRS-80—talk about a poker face!
- **Draw and Stud Poker**—These two programs will keep your game sharp.
- **No-Trump Bridge**—Play this popular game with your computer and develop your strategy.

This package's name says it all. Requires a TRS-80 Level II 16K. **Order No. 0063R $7.95.**



BOWLING LEAGUE STATISTICS SYSTEM This package is the answer to the prayers of harried bowling league scorekeepers. The Bowling League Statistics System will keep a computerized list of league data, team data, and data for each bowler. It is extremely flexible and has a total of 16 different options to let you modify the program to suit your league's rules. The program is very easy to use and has extensive "built in" aids to help you along. Requires TRS-80 Level II 16K. **Order No. 0056R $24.95.**

Level I and II

BACKGAMMON/KENO Why sit alone when you can play these fascinating games with your TRS-80?
- **Backgammon**—Play against the computer. Your TRS-80 will give you a steady challenging game that's sure to sharpen your skills.
- **Keno**—Enjoy this popular Las Vegas gambling game. Guess the right numbers and win big.

You'll need a TRS-80 Level I or II. **Order No. 0004R $7.95.**

OIL TYCOON Avoid oil spills, blowouts and dry wells as you battle to become the world's richest oil tycoon. Two players become the owners of competing oil companies as they search for oil and control their companies. Requires a TRS-80 4K Level I or II. **Order No. 0023R $7.95.**

BOWLING Let your TRS-80 set up the pins and keep score. One player can pick up spares and get strikes. For the TRS-80 Level I 4K, Level II 16K. **Order No. 0033R $7.95.**

AIR FLIGHT SIMULATION Turn your TRS-80 into an airplane. You can practice takeoffs and landings with the benefit of full instrumentation. This one-player simulation requires a TRS-80 Level I 4K, Level II 16K. **Order No. 0017R $7.95.**

GOLF/CROSSOUT Have fun with these exciting one-player games. Included are:
- **Golf**—You won't need a mashie or putter—or a caddie, for that matter, to enjoy a challenging 18 holes.
- **Crossout**—Remove all but the center peg in this puzzle and your neighbors will call you a genius.

You'll need a TRS-80 Level I 4K, Level II 16K. **Order No. 0009R $7.95.**

HAM PACKAGE I This versatile package lets you solve many of the commonly encountered problems in electronics design. With your Level I 4K or Level II 16K TRS-80, you have a choice of:

- **Basic Electronics with Voltage Divider**—Solve problems involving Ohm's Law, voltage dividers, and RC time constants.
- **Dipole and Yagi Antennas**—Design antennas easily, without tedious calculations.

This is the perfect package for any ham or technician. **Order No. 0007R $7.95.**

BASIC AND INTERMEDIATE LUNAR LANDER Bring your lander in under manual control. The Basic version is for beginners; the Intermediate version is more difficult with a choice of landing areas and rugged terrain. For one player with a TRS-80 Level I 4K, Level II 16K. **Order No. 0001R $7.95.**

SPACE TREK II Protect the quadrant from the Invading Klingon warships. The Enterprise is equipped with phasers, photon torpedoes, impulse power, and warp drive. It's you alone and your TRS-80 Level I 4K, Level II 16K against the enemy. **Order No. 0002R $7.95.**

ELECTRONICS I This package will not only calculate the component values for you, but will also draw a schematic diagram, too. You'll need a TRS-80 Level I 4K, Level II 16K to use:

- **Tuned Circuits and Coil Winding**—Design tuned circuits without resorting to cumbersome tables and calculations.
- **555 Timer Circuits**—Quickly design astable or monostable timing circuits using this popular IC.
- **LM 381 Preamp Design**—Design IC preamps with this low-noise integrated circuit.

This package will reduce your designing time and let you build those circuits fast. **Order No. 0008R $7.95.**

SANTA PARAVIA AND FIUMACCIO Become the ruler of a medieval city-state as you struggle to create a kingdom. Up to six players can compete to see who will become the King or Queen first. This program requires a 16K TRS-80 Level I & II. **Order No. 0043R $7.95.**

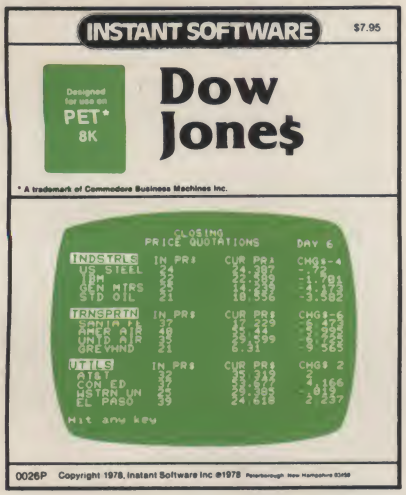
PET**

QUBIC-4/GO-MOKU Play two ancient games on your modern PET. The two programs included are:

- **Qubic-4**—Play a multi-dimensioned game of tic-tac-toe.
- **Go-Moku**—Line up five of your men while blocking the PET's moves.

These one player games require 8K of memory. **Order No. 0038P $7.95.**

TREK-X Command the Enterprise as you scour the quadrant for enemy warships. This package not only has superb graphics, but also includes programming for optional sound effects. A one-player game for the PET 8K. **Order No. 0032P $7.95.**



DOW JONES Up to six players can enjoy this exciting stock market game. You can buy and sell stock in response to changing market conditions. Get a taste of what playing the market is all about. Requires a PET with 8K. **Order No. 0026P $7.95.**

DUNGEON OF DEATH Battle evil demons, cast magic spells, and accumulate great wealth as you search for the Holy Grail. You'll have to descend into the Dungeon of Death and grope through the suffocating darkness. If you survive, glory and treasure are yours. For the PET 8K. **Order No. 0064P $7.95.**

MORTGAGE WITH PREPAYMENT OPTION/FINANCIER These two programs will more than pay for themselves if you mortgage a home or make investments:

- **Mortgage with Prepayment Option**—Calculate mortgage payment schedules and save money with prepayments.
- **Financier**—Calculate which investment will pay you the most, figure annual depreciation, and compute the cost of borrowing, *easily and quickly.*

All you need to become a financial wizard with an 8K PET. **Order No. 0006P $7.95.**

CASINO I These two programs are so good, you can use them to check out and debug your own gambling system!

- **Roulette**—Pick your number and place your bet with the computer version of this casino game. For one player.
- **Blackjack**—Try out this version of the popular card game before you go out and risk your money on your own "surefire" system. For one player.

This package requires a PET with 8K. **Order No. 0014P $7.95.**

CASINO II This craps program is so good, it's the next best thing to being in Las Vegas or Atlantic City. It will not only play the game with you, but also will teach you how to play the odds and make the best bets. A one player game, it requires a PET 8K. **Order No. 0015P $7.95.**

CHECKERS/BACCARAT Play two old favorites with your PET.

- **Checkers**—Let your PET be your ever-ready opponent in this computer-based checkers program.
- **Baccarat**—You have both Casino- and Blackjack-style games in this realistic program.

Your PET with 8K will offer challenging play anytime you want. **Order No. 0022P $7.95.**

TANGLE/SUPERTRAP These two programs require fast reflexes, and a good eye for angles:

- **Tangle**—Make your opponent crash his line into an obstacle.
- **Supertrap**—This program is an advanced version of Tangle with many user control options.

Enjoy these exciting and graphically beautiful programs. For one or two players with an 8K PET. **Order No. 0029P $7.95.**

DIGITAL CLOCK Don't let your PET sit idle when you are not programming, put it to work with these two unique and useful programs:

NEW

- **Digital Clock**—Turn you PET into an extremely accurate time-piece that you can use to display local time, time in distant zones, and as a split time clock for up to nine different sporting events.
- **Moving Sign**—Let the world know what's on your mind. This program turns your PET into a flashing graphic display that will put your message across. **Order No. 0083P $7.95.**

PENNY ARCADE Enjoy this fun-filled package that's as much fun as a real penny arcade—at a fraction of the cost!

- **Poetry**—Compose free verse poetry on your computer.
- **Trap**—Control two moving lines at once and test your coordination.
- **Poker**—Play five card draw poker and let your PET deal and keep score.
- **Solitaire**—Don't bother to deal, let your PET handle the cards in this "old favorite" card game.
- **Eat-'Em-Ups**—Find out how many stars your gobbler can eat up before the game is over.

These six programs require the PET with 8K. **Order No. 0044P $7.95.**

MIMIC Test your memory and reflexes with the five different versions of this game. You must match the sequence and location of signals displayed by your PET. This one-player program includes optional sound effects with the PET 8K. **Order No. 0039P $7.95.**

PERSONAL WEIGHT CONTROL/BIORHYTHMS Let your PET help take care of your personal health and safety:

- **Personal Weight Control**—Your PET will not only calculate your ideal weight, but also offer a detailed diet to help control your caloric intake.
- **Biorhythms**—Find out where your critical days are for physical, emotional, and intellectual cycles.

You'll need only a PET with 8K memory. **Order No. 0005P $7.95.**

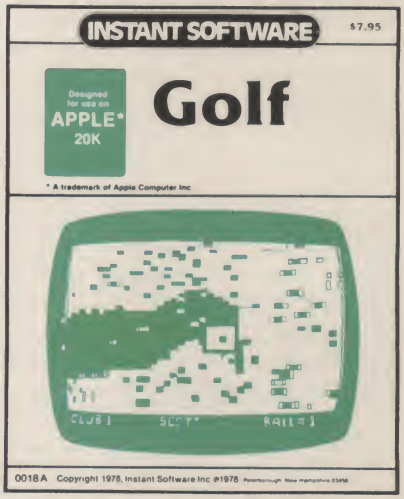
BASEBALL MANAGER This pair of programs will let you keep statistics on each of your players. Obtain batting, on-base, and fielding averages at the touch of a finger. Data can be easily stored on cassette tape for later comparison. All you need is a PET with 8K. **Order No. 0062P $14.95.**

Apple***

BOWLING/TRILOGY Enjoy two of America's favorite games transformed into programs for your Apple:

- **Bowling**—Up to four players can bowl while the Apple sets up the pins and keeps score. Requires Applesoft II.
- **Trilogy**—This program can be anything from a simple game of tic-tac-toe to an exercise in deductive logic. For one player.

This fun-filled package requires an Apple with 20K. **Order No. 0040A $7.95.**



GOLF Without leaving the comfort of your chair, you can enjoy a computerized 18 holes of golf with a complete choice of clubs and shooting angles. You need never cancel this game because of rain. One or two players can enjoy this game on the Apple with Applesoft II and 20K. **Order No. 0018A $7.95.**

DATA TAPES Use these high quality data tapes to record business or personal data. Four tapes per package. **Order No. 0067 $7.95.**

*A trademark of Tandy Corporation
**A trademark of Commodore Business Machines Inc.
***A trademark of Apple Computer Inc.

Cut along dotted line and mail today

Ordered by _____

Address _____

City _____ State _____ Zip _____

☐ Check ☐ Money Order ☐ VISA ☐ AMEX ☐ Master Charge

Card No. _____ Expiration date _____

Signed _____ Date _____

Order your Instant Software today!

Quantity	Order No.	Program name	Unit cost	Total cost
		Shipping and handling		$1.00
			Total order	

Instant Software Inc. Dept. M-ISA4
Peterborough, N.H. 03458

Apple Ciphers

An "apple a day," as the old saying went, used to keep the doctor away—but watch out! The Apple may now be preparing to send you a bill tomorrow from your friendly physician.

A. W. Brown
2048 Surrey Ln. NE
Roanoke VA 24012

An important question asked of almost all systems is their potential use in business. With this in mind, the Apple Computer Company has recently introduced two products: a firmware BASIC card and disk II. Combining these with the parallel interface printer card, the communications card (modem) and up to 48K, the Apple steps out as a leader in the field.

The single board computer provides many advantages but often limits expandability. Radio Shack provides expandability but requires the purchase of a $300 expansion interface. Apple has ensured expandability by integrating a seven-slot backplane in the existing cabinet. The slots, numbered 0 to 6, allow extension of the bus.

Firmware BASIC Card

Slot 0 is reserved for the Applesoft firmware card. This small printed circuit board contains Apple's 9-digit extended floating-point BASIC written by Microsoft). A unique feature of the card is a selection switch on the back side of the card. The two positions allow selection of floating-point or integer BASIC. This is a desirable feature in business applications as much of the text processing does not require floating-point arithmetic.

You might say, "What a nuisance it must be switching that switch!" I have trouble remembering to get everything hooked together correctly! Well, score one for the doctor (an apple a day, etc.)! The Apple performs automatic switching and selects the type of BASIC the program is written in.

The floating-point BASIC is an extended version containing most all of the commonly found functions and commands, full string-handling ability, outstanding graphics in color and runs extremely fast on the 6502-based system.

The most obvious feature missing (from a business standpoint) is the PRINT USING statement. The PRINT USING statement allows easy print formatting for reports. Without this, division calculations such as depreciation and amortization tables have a way of getting out of hand. (Try telling a new home owner his monthly house payment is $325.623492!) Without the PRINT USING statement, preparing columnar printing is difficult. Floating point will not display trailing zeros; consequently, left-justified output can be all over the page!

But alas, all is not lost. By using the available string capabilities, you can shave the numbers to two places to the right of the decimal, padded with zeros, if necessary, and the result can be printed right-justified. Not quite as easy, but essentially the results are the same.

The nicest thing about the firmware card is the memory-

Photo 1. Apple II and disk in good working position. Note the groove above the keyboard. This is the perfect place to put pencils or pens!

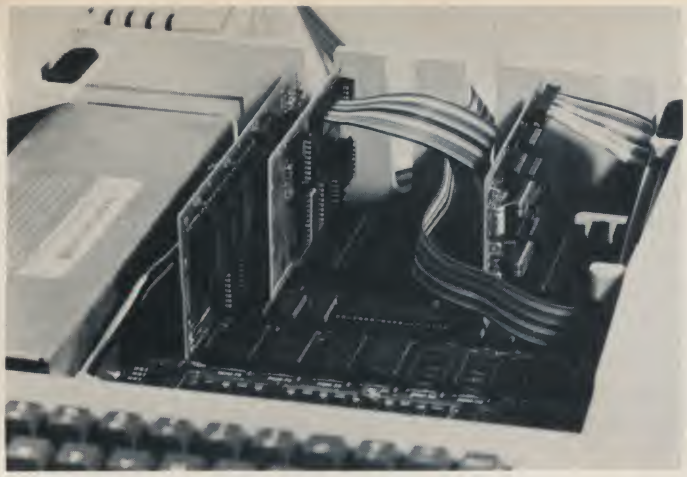


Photo 2. Inside the Apple II. Note the seven expansion slots. In this system they are utilized as follows: (left to right) Applesoft firmware BASIC card, parallel printer card and disk driver card.

```
1200 CALL  - 936
1205 PRINT : PRINT "                                        "
1210 PRINT : PRINT "ENTER MISC COMMENTS  (OPTIONAL)": PRINT
1220 PRINT "40 CHARA MAX": PRINT
1230 INPUT "";MC$
1232 IF  LEN (MC$) < 40 THEN L =  LEN (MC$):E$ =  LEFT$ (P$,(40 - L)):MC$ = MC$ + E$
1234 IF  LEN (MC$) > 40 THEN E$ =  LEFT$ (MC$,40):MC$ = E$
1240 CALL  - 936
1250 PRINT " ** FILE BEING CREATED **"
1260 M1$ = N$ + A1$ + A2$ + C$ + A$ + B$ + PH$ + W$ + ER$ + O$
1270 M2$ = H$ + A3$ + HE$ + WA$ + O1$ + DR$ + A4$
1280 M3$ = S$ + N1$ + I$ + A5$ + MC$ + DA$ + DA$ + MC$
1281 B = 0
1282 R$ =  STR$ (N): IF  LEN (R$) < 5 THEN L =  LEN (R$):E$ =  LEFT$ (P$,(5 - L)):R$ = R$ + E$
1284 MD$ = N$ + A1$ + A2$ + C$ + I$ + N1$ + S$ + PH$ + R$
1285 PRINT : PRINT : INPUT "PRESS ENTER TO WRITE FILE ";Z$
1290 PRINT "OPEN NEW:MSTRS,L450"
1300 PRINT "WRITE NEW:MSTRS,R";NN
1310 PRINT M1$: PRINT M2$: PRINT M3$
1320 PRINT "CLOSE NEW:MSTRS"
1324 PRINT : PRINT " ** FILE WRITTEN **"
1328 PRINT "OPEN MSTR,L160"
1330 PRINT "WRITE MSTR,R";N
1332 PRINT MD$: PRINT B
1335 PRINT "CLOSE MSTR"
1338 N = N + 1:NN = NN + 1
1340 PRINT . PRINT . PRINT . INPUT "CREATE ANOTHER MASTER FILE  1=Y  2=N ";A
1350 ON A GOTO 310,1360
1360 PRINT "OPEN MSTR:PTR,L10"
1370 PRINT "WRITE MSTR:PTR"
1380 PRINT N
1390 PRINT "CLOSE MSTR:PTR"
1400 CALL  - 936: PRINT : PRINT : PRINT "POWER ON THE LINE PRINTER"
```

Program listing.

conservation consideration. In a 32K system, a little over 30K is usable with BASIC up and running! From a cost-justification standpoint, a 16K memory add-on is $300. The firmware card, which frees up between 8 and 10K, was introduced at $100. Even with the loading speed of a disk BASIC, it's nice to have it running on power-on and to have the extra memory available.

Disk II

The primary requirement of an on-line, rapid-access business system is disk. Apple's approach to this need is ideally suited for the business community. Enter disk II. After getting over the dilemma of telling people that I was not buying an apple dish, but rather an Apple disk, I joyously set out to create wonderful disk-driven programs.

All was not in order, however, and after a frustrating weekend I wasn't sure if I had a disk or dish! I knew what was supposed to be happening but didn't. What made things even worse was that one of the demonstration programs worked fine! I could get the "Little Tan Box" to whir and click and make an assortment of interesting sounds, but file handling was, at best, uncooperative. I could save, load, rename, initialize, run, delete, lock, unlock and catalog to my heart's content, but the open/close and read/write commands just would not work.

The manual indicates "any DOS command can be used from within a BASIC program. This is done by printing a string that consists of a (control) D followed by the command."

Well, what exactly does this mean? I had become familiar with the simple open, close, read and write statements used by many other systems. The Apple requires the commands to be entered in the following manner: line # PRINT "CTL D OPENFILENAME,L". But the control D does not appear; instead, what you see is: line # PRINT "OPENFILENAME,L". The L followed by a number specifies the file length. It's easy to get all messed up, and this explains why my retyped version of the demo would not work.

Keeping the (control D) procedure in mind, I diligently typed away, saved the program, loaded and ran and it still didn't work! At this point my Apple disk was about to go the route of applesauce, but a call to Apple answered the question. Two extremely important points are not spelled out in the manual as clearly as they might be.

I/O to disk requires that files be opened (PRINT "CTL D OPEN FILENAME,L"), the usual read or write (PRINT "CTL D READFILE NAME" or PRINT "CTL D WRITEFILENAME") and then a PRINT statement such as PRINT A$ to send the string A$ to disk. To read, an INPUT statement, such as INPUT A$, accomplishes the task.

The manual indicates that all INPUT and PRINT statements executed subsequent to the READ or WRITE commands will I/O the disk. Well, that's exactly what happens! During a WRITE, all characters displayed on the screen or sent to the printer go to the disk.

What is required is to OPEN the file, PRINT or INPUT and then immediately CLOSE (or disable the READ/WRITE) the file prior to executing any other PRINT or INPUT statements. The program listing is a portion of a medical-office package I have written for the Apple.

The "NEW:MSTRS" file is opened at line 1290. The length is specified at 450 bytes. The "CTL D" is there, but remember, it does not show. Line 1300 sets the mode for output, and line 1310 sends the values for M1$, M2$ and M3$ to disk. Without the CLOSE at line 1320, line 1324 in its entirety, including line number and punctuation,

Photo 3. A view from behind. Note the cassette I/O and video jack. The ac cord detaches—convenient for moving the unit.

will be sent to the disk.

Random access file handling is achieved by specifying a relative record number (here the variable NN) as in line 1300. Sequential access handling is achieved by omitting the record number as in line 1370.

Record Length

The DOS manual does not make reference to the handling of more than one variable per record. This seems to imply that only one variable per record can be assigned. This means that a customer master file, for instance, which may contain a name, address, city, state, zip (three string variables), an ID, Social Security or customer number (a numeric variable), two or three status pointers (strings or numerics) and possibly a balance and special comments fields (numeric and strings), would require a separate READ/WRITE to handle each variable. This also means a separate record number for each variable. Using this procedure, you cannot read or write the entire file with a single record number.

This procedure *can* be accomplished by careful attention to record length, counting each character, considering signs for numerics and counting the carriage return as a character. As mentioned above, after a READ, all subsequent INPUT statements will READ from disk. An unlimited number of variables can be READ in this manner. The length specifier becomes of paramount importance here.

While the INPUT statement will read unlimited variables using a carriage return as the variable separator, the WRITE will write an unlimited quantity of variables up to the length specified in the OPEN statement. The next record will be written beginning with the byte position incremented by the OPEN length. If your file is OPENed for 100 bytes, and the record is 150 bytes, the last 50 bytes of the preceding record will be written over when the next record is written. Can be quite a problem if not managed.

In the program listing, 25 variables (lines 1260-80) are concatenated and written at line 1310. Here the length of the records is set to a maximum of 450 bytes.

Using this procedure, you can achieve tremendous disk flexibility because sectors or blocks, usually 128 or 256 bytes, do not have to be moved. No minimum number of sectors is required for a file, which allows the creation of a pointer file, for instance, that occupies as little as one byte. Line 1360 demonstrates a single variable record, 10 bytes long. This procedure allows large, multi-variable records to be handled with a single record number.

DOS

The disk operating system (DOS) is versatile. It occupies roughly 10K of memory, as opposed to the 2 to 4K in many other systems. For your 10K payment, you receive a substantial return on your investment. One of the most attractive is the APPEND command. This performs an OPEN, determines the last record written to the file and then writes the next record sequentially to the file.

The OPEN command sets pointers for read/write routines to the first record in the file. True random-access ability requires a selective record number.

The EXEC command allows keyboard immediate mode commands to be stored and executed from disk automatically. Programs can be "built" from disk files.

Another feature of the DOS is the ability to access any single byte within a record for manipulation or alteration. The DOS allows up to 16 files to be open simultaneously, and the Apple allows up to 14 disk drives to be controlled by the CPU. The format is soft sectored with 116K bytes of formatted space.

System Features

Custom initialization (booting the system with any program) provides truly professional applications. There are numerous other commands: direct memory image files, a POSITION command for random jumps with subsequent sequential reads and a VERIFY command that checks the data on disk for self-consistency, indicating that damage or incorrect writes have not occurred.

I needed a system that was small, lightweight and versatile to handle business applications. The days of a versatile desk-top computer system (that leaves you some space on the desk to write) are here. Photo 5 shows exactly how portable the system is.

The design of the Apple is well suited. The CPU keyboard is low and flat. Manuals and printouts can lie on *top* of it for reference. The folks at Apple even built a small groove above the keyboard—just perfect for some pencils.

As shown in Photo 4, the Apple, video, disk and printer all sit on top of my card table, and I have room left to write! (And the card table hasn't collapsed from all the weight either; the Apple weighs only about five pounds.)

The Apple with 32K, the firmware BASIC card, single or dual disk, a video monitor and printer with BASIC and DOS gives the user about 20K of working core, which is a tremendous amount of space. The extended BASIC and DOS provide the ability to handle any user application required.

My medical-office package, written for a surgeon in southwestern Virginia, provides full, random-access patient record files, accounts receivable/payable, transactions analysis, invoice/billing preparation, full general ledger and payroll and a soon-to-be-added interface to accommodate National CPT 5 recognized insurance filing and forms preparation. And yes, friends, it's all running on an Apple! ■

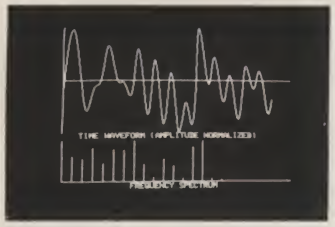
Photo 4. A compact and versatile system that fits on top of a table.

Photo 5. Have computer will travel. Shown here are cases to carry the entire system. Because of their light weight, the computer, disk and case weigh scarcely more than a bag of potatoes. Very portable.

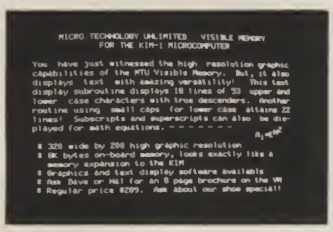
OUR VISIBLE MEMORY ADDS FUNCTION AND FUN TO YOUR 6502

This DOT MATRIX display board doubles as an 8K MEMORY. You can use it as a display, memory expansion or both with graphic and text display software available. You get resolution graphics with no wait states, no snow, and no processor overhead. K-1008 ASSEMBLED and TESTED $240.00, BARE BOARD $40.00 K-1008-1 GRAPHIC/TEXT UTILITY SOFTWARE LISTING $20.00.

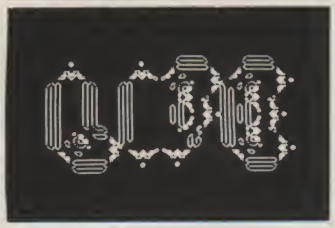
As a dot matrix formatted 200 high by 320 wide, it allows high resolution patterns to be displayed and evaluated. It enhances system performance for data acquisition displays, math equation plotting, etc.



For charts and graphs, it is valuable in the educational, research and business fields. Shown to the right is a single period of a complex frequency waveform and its frequency spectrum chart.



For text display, dot matrix is the ultimate. Any character set the user desires is possible. Even subscript and superscript in the same column, and—mixed text and graphics. The improved man-machine interface for an unskilled operator increases productivity.



Graphics allows you to program games with much more accurate representation of your game because YOU DETERMINE THE SHAPES on the display, not a ROM character generator. Our LIFE program allows tremendous creativity in creating complex colonies for observation of generation growth and decay.

Developed by a leading group of New England engineers for interface with the three 6502 KIM BUS systems (KIM, VIM, AIM). The K-1008 requires only the processor card and its power supply to function as a memory. Add a monitor and you have graphics and text display available. Micro Technology also makes K-1000 Power Supplies, K-1005 Card Files, K-1002 8 Bit Music Systems (with advanced software), K-1020 Regulated Wire Wrap card, K-1012 IO/COMM/PROM/2708 Programmer card, K-1016 16K Memory, all sold assembled and tested or as bare boards. Write for technical information, prices and terms.

Overseas orders—include $3.00 for shipping.

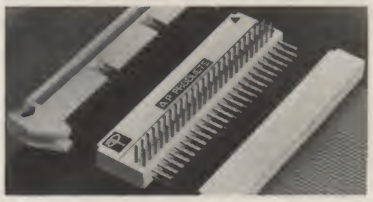
Micro Technology Unlimited

✓ M44

P.O. Box 4596 Manchester NH 03108

INSTANT.

The way you check line-by-line with an A P Intra-Switch or Intra-Connector.



You plug your Intra-Switch in-line with standard socket connectors, and instantly you've got a separate, independent on-off switch for each and every line in your flat ribbon cable. To switch, you nudge with a pencil point. It's that quick.

Imagine how much time and trouble Intra-Switch will save you in your diagnostic and quality testing, your programming and selective line inhibiting.

Or, plug in your Intra-Connector (see box) the same way, and you have an extra set of male contacts at right angles. Instant line-by-line probeability—and an easy way to tap your system and daisy chain it into new areas.

Both Intra-Connectors and Intra-Switches come in 20, 26, 34, 40 and 50-contact models.

Where? At your nearby A P dealer. Where's that? Phone (toll-free) 800-321-9668. And ask for the complete A P catalog, The Faster and Easier Book.

AP PRODUCTS INCORPORATED ✓ A22
Box 110E • 72 Corwin Drive
Painesville, Ohio 44077
Tel. 216/354-2101
TWX: 810-425-2250

Faster and Easier is what we're all about.

✓ Reader Service—see page 179

Rod Hallen
Road Runner Ranch
PO Box 73
Tombstone AZ 85638

The PAIA 8700

For under $200, you can have the computer that's thoroughly examined in this article.

Although personal computing is still in its infancy, the multitude of products that have been produced, or will soon be introduced, is enormous. From the Altair and its contemporaries to the PET, TRS-80 and KIM-1, the hobbyist and small businessman have a large selection of computer equipment to choose from.

You can spend thousands of dollars or you can spend a few hundred dollars. Since you get what you pay for, there must be different levels or capabilities of equipment to explain this large price range. Let's look at the bottom end of the scale and investigate one computer that is available for well under $200 and see what it will do.

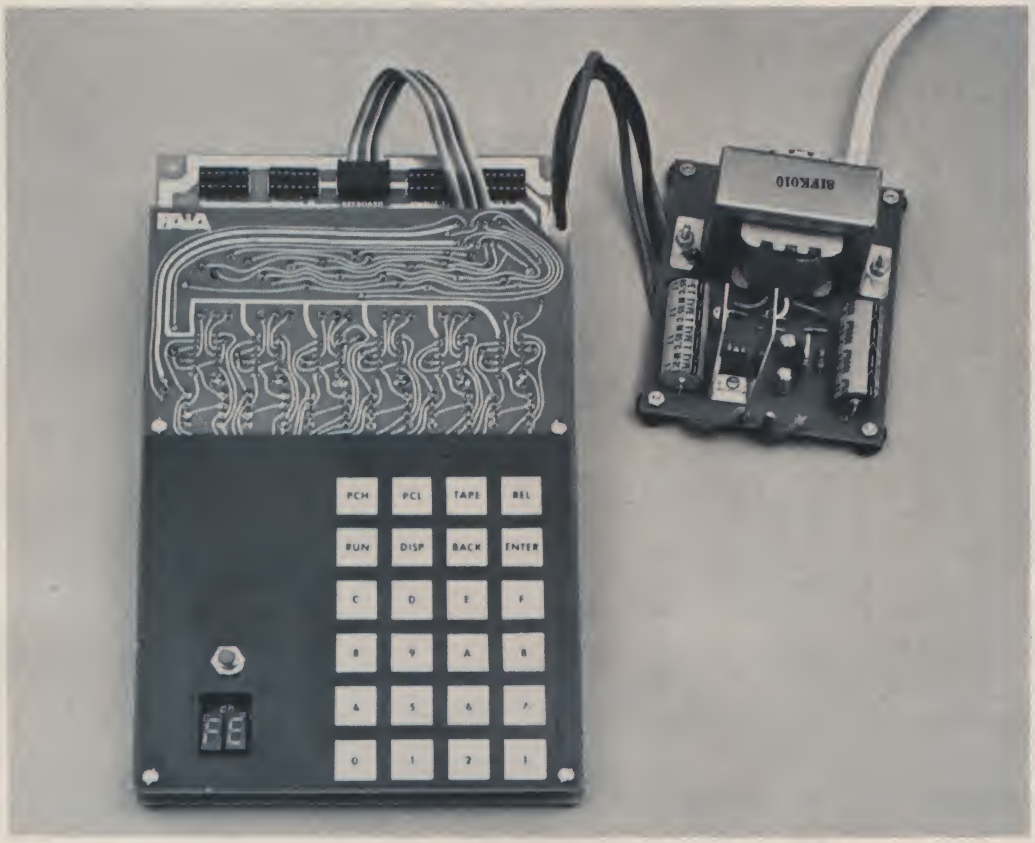


Photo 1. The PAIA 8700 and its optional power supply. The keyboard is mounted on top of the CPU board with 3/4 inch standoffs. The vacant IC sockets at the top are the input/output connectors. The expansion connectors are under the keyboard. Note the reset button and digital readout in the lower left-hand corner.

The PAIA 8700 is made by PAIA Electronics, Inc. (see Table 1 for address and prices). If you are into synthesized music, you are probably familiar with PAIA's extensive line of music synthesizer modules and systems. Write to ask them for their catalog. It contains many items that can be used in computer music systems.

The 8700 is the most compact computer I've seen (see Photo 1 to get an idea of what I mean). It is 6 x 10 x 1 inches overall and weighs less than a pound. These dimensions and weight do not include the power supply, which is an option and is external to the main unit as shown. The price of both is very reasonable.

Before discussing assembly and operation, let's examine its capabilities and limitations. First and foremost, this is not a general-purpose computer. It is intended for controller applications, and I will explore some of these after a while. The main limiter is the microprocessor: the MCS 6503 by MOS Technology, which is a little brother to the familiar 6502 used in the KIM-1, PET and Apple.

I call it a little brother because it is packaged in a 28-pin DIP (dual in-line package) and was designed for applications in which a lot of memory is not required. In order to put a 40-pin microprocessor into a 28-pin IC, something had to go. Part of


$15
OFF
SAVE
50%
SAVINGS
CERTIFICATE
ONE YEAR (12 ISSUES)
FOR ONLY $15.
Invest in the new Kilobaud Microcomputing! Earn big dividends every month and get one year (12 issues) for only $15 by taking advantage of this discount offer. Mail this certificate now and save 50% off the $30 newsstand price.
Canadian subscriptions add $2 per year. All other foreign subscriptions $26 one year only payable in U.S. funds. Please allow four to six weeks for delivery of first copy.
☐ Payment enclosed
☐ Bill me
Name
Address
City
State
Zip
Kilobaud Microcomputing
Subscription Services Department
P.O. Box 997 • Farmingdale NY 11737
B98I

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD
FIRST CLASS PERMIT NO. 17 PETERBOROUGH NH 03458

POSTAGE WILL BE PAID BY ADDRESSEE

kilobaud
MICROCOMPUTING T.M.

Subscription Department • Box 997
Farmingdale NY 11737

that something was the address lines A12 to A15, which means that the 6503 is limited to 4096 bytes of addressable memory (2^{12} = 4096).

This is why you wouldn't want to consider the 8700 as your general-purpose computer. Even if you could squeeze in a BASIC interpreter, you wouldn't have much room left for entering and running programs. You must program the 8700 in assembly language if you are going to use it as a controller.

ADDRESS	CODE	LABEL	INSTRUCTION	COMMENTS
0000	A9 00	BEGIN	LDA #0	CLEAR ACCUMULATOR
0002	8D 20 08	REPEAT	STA $0820	DISPLAY ACC
0005	A0 00		LDY #0	CLR Y
0007	A2 50		LDX #$50	SPEED SETTING IN HEX
0009	C8	LOOP	INY	DELAY LOOP
000A	D0		BNE LOOP	BRANCH UNTIL Y = 0
000C	CA		DEX	CHECK SPEED
000D	D0 FA		BNE LOOP	BRANCH UNTIL X = 0
000F	F8		SED	SET DECIMAL MODE
0010	18		CLC	CLR CARRY
0011	69 01		ADC #1	ADD 1 TO ACC
0013	4C 02 00		JMP REPEAT	DO IT ALL AGAIN

Program listing. Loading and running this listing in the 8700 will cause the display to count from 00 to 99 continuously. The number stored at 0008 (50) determines how fast the count goes. Entering a smaller number here will make the count go faster. Changing 000F to D8 will change the count to hex. Can you tell why? This is, of course, written in 6502 assembly language.

Assembly and Testing

The 8700 comes in kit form, and our first task is to put it together and test it. The 60-page manual supplied with the kit makes both of these chores easy to accomplish. All part identifications are screen printed on the boards, which also helps.

Parts are installed and checked off one at a time. Mounting and soldering are explained, and a layout diagram is provided. Two circuit boards are involved in construction—the main (CPU) board and the keyboard, which, after construction, are mechanically bolted together and electrically connected with a 14-conductor ribbon cable that ends in a 14-pin plug for easy disassembly. I am an experienced kit builder, and my total construction time was one hour and ten minutes. Even if you take twice that long, this is still an easy one-evening project.

Here are my few negative thoughts on the kit. I guess Heath has spoiled me because I was surprised that no solder was supplied . . . especially since the nearest solder store is 25 miles away. I also like tinned, soldermasked boards. The main board is tinned but not soldermasked, while the keyboard is bare copper and has started to tarnish. I like tinned boards because they are easier to solder to and soldermasking cuts down on the chances of inadvertent solder bridges between closely spaced components.

Neither board is densely populated (see Photo 2), and if you're careful, bridges shouldn't be a problem. One design procedure that helps in this regard is the lack of traces running between IC pads on the solder side of the board. All of the ICs on the main board are mounted in sockets, but those on the keyboard are not. I prefer sockets for all ICs, and since those on the keyboard are CMOS it is fairly easy to destroy one during installation and have a devil of a time removing it again. You can provide your own sockets, as I did.

The only other complaint I have is that the power connector is an unusual type, and unless you buy the optional power supply you don't get the matching plug. I soldered wires from my supply directly to the connector posts.

The 8700 monitor PROM (PIEBUG) contains a "Self-Test Micro-Diagnostic" routine that is designed to help you troubleshoot the unit when you are finished putting it together. It is intended to be used in conjunction with an oscilloscope, but I ran through it with a logic probe and satisfied myself that everything was OK. You can't look at pulse widths or duty cycles that way, but at least you know whether the logic level is steady or pulsing and whether it is high or low.

Large, simplified schematics and flowcharts also help with troubleshooting. A complete source and object listing in hex of the firmware monitor (PIEBUG) with comments is a welcome addition. A memory map and interrupt, break and reset vectors are provided to make programming easier. It is probably well to mention that assembly-language programming of the 8700 is done in hex.

I hope that I haven't scared anyone with this talk about troubleshooting. It probably won't be necessary. The whole layout is very simple and even the novice builder shouldn't have any problem. The manufacturer stands ready and willing to provide help by mail or phone.

One unusual feature of the 8700 is the keyboard. Look closely at Photo 1. If the keys look like they are painted on the board, that's because they are! The keyboard has no moving parts. The capacity of your finger touching the desired keypad triggers an IC gate for data entry. It takes a little getting used to but quickly seems like the natural way to do it. The lack of moving parts should make for a long, trouble-free life. If you buy the cassette option, the keyboard will beep along with each key entry.

In addition to the *PAIA 8700 Assembly and Using Manual,* the kit also comes with the *MOS Technology MCS6500 Programming Manual.* This big 240-page 8½ x 11 inch book is a complete course on assembly-language-programming the 6500 family of microprocessors. I say family because there are almost a dozen different versions of the 6502. All variants, including the 8700's 6503, use the same instruction set. It is, therefore, possible to write programs for the 8700 on a larger machine and then transfer them. This would be especially desirable if the larger machine were running a 6502 assembler.

Note the options in Table 1. The cassette interface allows the recording and playback of your programs. The optional music programs listed are on cassette tape. I didn't purchase the power supply because I already had the necessary voltages available. The current requirements aren't given in the manual, but I measured mine at +5 volts at 400 mA and −9 volts at 45 mA. These must, of course, be regulated, and you can build a suitable supply for a reasonable price if you already have most of the parts. Otherwise, the power supply kit is a good buy.

The PAIA 8700 Package

I've discussed the 6503 microprocessor, but let's explore it just a little bit more. As I've said it is completely software compatible with the 6502 but has certain limitations because of its intended use. Missing, in addition to the address lines (A12 to A15), are the Ready, Sync and Set Overflow leads. This lack of leads will probably not limit system use, except for the curtailed addressing capability.

The 8700 has room for 1K of *RAM and 1K of ROM* on the CPU board. Provided with the kit are the PIEBUG monitor ROM (a 256-byte 1702) and 512 bytes of RAM (four 2112s). Another 512

PAIA 8700 Computer Kit	$149.95
Options:	
Power Supply Kit	24.95
Cassette Interface Kit	22.50
Firmware:	
MUS-1 Music Generator PROM	22.00
Software:	
POLY—Synthesizer Program	
DRUMSYS—Drum Operating Program	
Seque 1.0—Ultimate Sequencer Program	

Software includes cassette tape, documentation and interfacing details for $4.95. Available without tape for $2.
Prices do not include postage.

PAIA Electronics, Inc.
PO Box 14359
Oklahoma City OK 73114

Table 1: The 8700 and its options, prices and manufacturer.

bytes of RAM can be added to the board for about $16 at current market prices. The MUS-1 PROM (see Table 1) contains a relatively complex music generator that can be installed on the CPU board. See the paragraphs about the expansion connectors for information concerning adding even more memory.

In order to make practical use of any computer, it is necessary to get information into and out of it. That is the purpose of I/O (input-output) ports, and the 8700 is well supplied with them. The on-board ports interface the keyboard and the digital display. The keyboard is operated by the capacity of your fingers and contains eight PIEBUG commands as well as the hex characters 0 1 2 3 4 5 6 7 8 9 A B C D E F.

The only precaution in the use of the keyboard has to do with the TAPE command. The TAPE key should never be touched if you don't have the cassette option. Otherwise, you'll destroy any programs that you have in memory. The manual emphasizes this by warning that this will load your memory with garbage and eat your lunch!

Just to the left of the digit 8 in Photo 1 is a push button. This is the reset button, which is used to gain control of the processor each time that the computer power is turned on or when a program has gone astray. This latter problem will usually be caused by an incorrectly written program step that forces a continuous loop or branches to nonexistent memory.

Below the Reset button are two digital readouts that serve as a visual output port . . . sort of like a video screen that can only display two characters at one time. The two characters displayed are the last two that you have entered from the keyboard or the contents of a memory location if you key DISPLAY, ENTER, PCH or PCL (more on this later).

A latched eight-bit parallel output port is used to control external devices or processes. A strobe is also provided to indicate when the port has been loaded and when valid data is available on the data lines. Two pages are devoted to describing the operation and use of the output port. A simple program that will cause the port data lines to count from 0 to 255 in binary as an exercise is written. Information is also given on how to use the port data lines to control CMOS or TTL gates and transistor relay driver circuits.

Two eight-bit parallel input ports are also provided. These can be read by the processor, and the data derived can then be used by the program. The MCS 6500 family of microprocessors addresses I/O ports as memory locations. This is similar to the way the 6800 handles I/O. If a memory read instruction addresses an input port, then the data read will be whatever is tied to that port. Various methods of inputting information are discussed. Input ports rate two pages of the manual.

A cassette port is available if the cassette option is purchased. The option consists of parts that are installed on the

✓ Reader Service—see page 179

CPU board. Recorder motor control is one feature that is provided. I have recently written for the cassette option but I haven't received it yet.

And finally, the data and address buses are available through expansion connectors. This will allow you to add more memory, peripherals, ports or whatever. While the data lines will handle five CMOS or one LS TTL load and the address bus will handle one TTL load, it is probably best if all lines extended off the board are buffered.

The NMI (non maskable interrupt), IRQ (interrupt request) and R/W (read/write) leads, as well as some other control lines, are also available at the expansion connectors. All of the I/O port and expansion connectors are 14-pin IC sockets. Connection to them is made with 14-pin plugs that have solder tabs on the top or ribbon cables attached to them. Many companies make both types of these plugs.

The monitor program contained in the *PIEBUG ROM* has some interesting features. I mentioned earlier the "Self-Test Micro-Diagnostic." In addition, each of the keyboard command functions is the result of a routine in PIEBUG.

Touching four hex keys and then DISPLAY will cause the contents of the location pointed to by the four-key entry to appear on the display. If you touch 001A and DISPLAY, then the display will hold the contents of that location. Touching ENTER will step the display counter by one and the display will hold the contents of the next location (001B). In this way, you can step through memory examining programs or data. To recap, the starting address is keyed in followed by DISPLAY and then the address count is incremented with the ENTER key.

Any time you want to change the contents of a memory location, you bring the location to the display (as described above), touch the new data and then ENTER. The new data will be entered and the address incremented by one to let you see the contents of the next location. The BACK key steps the address pointer backward by one with each touch.

After a program has been entered using the above keys, you touch in the starting address, DISPLAY and RUN. There is a short assembly-language program in the manual that is used as an example of how to enter a program (see program listing). This program causes the display to count from 0 to 99 and then start again. It will continue until you hit RESET. By making a few changes you can speed up or slow down the count. Make another change to place the count in hex instead of decimal. I believe that examples, even simple ones such as this, are the best way to teach a new subject.

The PCH and PCL keys display the current program counter. The manual calls these Pointer High and Pointer Low, but I prefer to call them Program Counter High and Program Counter Low, which is what I think PCH and PCL really stand for. The TAPE key has already been mentioned.

The REL key is an innovative time-saver. In writing assembly-language programs for the 6500 family, it is often necessary to figure relative addresses. A relative address is the number of address locations forward or backward a program must jump or branch to satisfy certain conditions.

Normally the programmer has to figure this out by hand. PIEBUG has a routine that does it for you. Whenever you enter an instruction that requires a relative address, you enter the absolute (actual) address of the jump or branch location and touch REL. The relative address will appear on the display and will also be entered at the correct memory location when you touch ENTER to move to the next entry address.

One plus feature of PIEBUG is a debug breakpoint routine. Any time that you want to stop a program at a certain point to examine the condition of the various registers, you substitute 00 for the op code at that point. When PIEBUG encounters a 00 op code during the running of a program, it will store all of the 6503 registers in certain desig-

✓ Reader Service—see page 179

nated memory locations, cause the display to read bb and return control to the keyboard. By examining these designated storage locations you can determine how well the program is running at that point. You can also change any of the registers or memory locations and then start the program running again from there.

System Applications

That pretty well defines the hardware and firmware attributes of the PAIA 8700. There is certainly an awful lot crammed into such a small package. Your next question is, "OK, but what can I use it for?" Let's skim over some of the things you might want to do with the 8700.

The most obvious answer is, "Make music!" PAIA manufactures music synthesizers, and, strangely enough, some of their equipment incorporates a mounting space for the 8700. But your computer can make music without a synthesizer. For now I'd advise you to order their catalog or go back over your computer magazine back issues for music articles.

Another application that comes to mind is printer buffering for a bigger computer. Your processor moves along at a microsecond clip, but most printers are a thousand or more times slower than that. Instead of having the processor wait while each individual character is handled by the printer, why not let your big machine dump blocks of characters to the 8700 and then go back to computing while the 8700 feeds the printer?

This wouldn't gain you much in a situation where the majority of the program is concerned with printing, but if the program computes, prints, computes, etc., for a while, a lot of time could be saved. My biorhythm program is an excellent candidate for such treatment. While time is not money in most hobbyist situations, if you are impatient or a businessman trying to make money, it is.

I recently saw a program in one of the magazines to make a KIM-1 run like a clock. This same program with a little modification would probably run on the 8700. This is OK, but digital clock chips are inexpensive, and you wouldn't be able to use the computer for anything else since it would always be running the clock program. I imagine that many other programs that are written for the KIM will also run on the 8700.

Another possibility is multiprocessing. Multiprocessing involves two or more processors working together on one chore. Many tasks that would fit in this category come to mind. Suppose that you want to control an organ, music synthesizer or other instrument. Why not let your big machine do the programming, arranging, scoring and program execution. The 8700 could be the actual controller of the instrument, and it in turn would be under the control of the larger machine.

This same analogy fits many other situations. You might not want to tie up your personal computer controlling a solar energy system, your fire and burglar alarms and other chores that really call for a dedicated controller. That is what the MCS 6503 (and the PAIA 8700) was designed for. It could monitor various conditions through its input and output ports and interrupt the main computer when it decided that a situation was developing that needed to be taken care of.

Another possibility is a programming trainer. If each student had an 8700, he could write, debug and run sample programs in assembly language. The knowledge thus gained could subsequently be used on larger machines that use the 6502.

Conclusion

While doing some research for this article, I came across a review of the 8700 in the February 1978 issue of a magazine called *Electronics Australia*. The anonymous writer was generally complimentary, although he criticized the manufacturer for not providing enough information for the novice. He felt that the supplier's message seemed to be, "Here it is, you figure out how to use it." Actually, the same can be said about almost any personal computer maker.

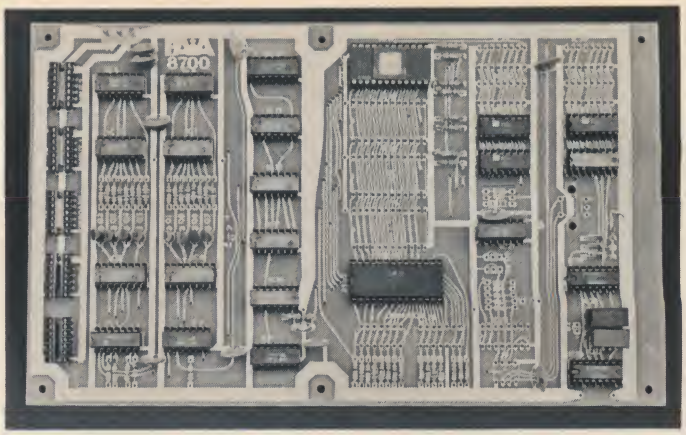


Photo 2. The PAIA 8700 CPU board. Notice the uncluttered layout. The 6503 CPU is just below the center of the board and the PIEBUG ROM is top center. The vacant socket positions from the center to the right-hand edge are for the cassette option, expansion connectors and additional RAM and ROM. The power connector is the three pins in the upper left corner. (Photos courtesy of PAIA)

At least PAIA attempts to explain the rudiments of programming and usage in their manual. The MOS Technology 6500 programming manual that they provide is also a great help for those of us who are not too familiar with the 6502 instruction set. I didn't get any of this type of information with my thousand dollar plus 8080 machine.

PAIA's foremost intention for this computer is, of course, the generation of music. Music is their business, and the fact that the 8700 fits into many of their synthesizers indicates their primary goal. But don't let that hide the many applications that are possible. I've touched on a few, but you should be able to think of many more.

I have always shied away from control applications with my SOL because I use it a lot for program writing, manuscript printing and general experimentation. With a separate dedicated controller I can investigate more areas of the world of personal computers at one time. I think that I'll work on the music and printer buffer ideas first.

Whenever I consider buying something new, whether it is computer related or not, I try to decide if it is worth what I'm going to have to spend for it. This takes into account such things as original cost, probable lifetime, utility and personal desires. I do the same calculations when evaluating a product or service for a review article such as this.

Is the PAIA 8700 worth the price asked for it or is there something else available at or near the same cost that will do the job better? Taking into account the limitations of the 6503 and considering its possibilities as a dedicated controller and its low price, I believe that it is a viable purchase in three areas.

First, for the novice who is short on cash, it makes a nice learning machine. He can move up to something more sophisticated later and then use this as a controller. Second, this is a good starting point for the music buff who would like to try his hand at computer music. Using the modules and systems available from PAIA or building from scratch, I believe that complex, sophisticated results are possible. Third, the dedicated controller applications already mentioned enhance its appeal.

I really would like to find a 6502 assembler that will run on my 8080 machine and then programming would move along at a greater pace, but in the meantime I'm learning 6502 assembly-language programming little by little. Taking into consideration all that we've discussed, is there a place in your plans for a compact, inexpensive, useful personal computer product? If so, consider the PAIA 8700. ■

Don't Throw Away That Monitor—Yet!

If you've had the problem of what to do with a monitor ROM using TTL output when you want to install a visual-display memory that gets its data from the data bus, then read on.

LKR Williams
2 Pope St.
Plimmerton, New Zealand

What do you do with a monitor ROM that uses serial TTY output when you want to install a visual-display memory board that gets its data directly from the data bus? Having just solved this problem, I'll share with you my solution, which may be of interest to others in the same position.

Introduction

My system uses a Mostek F8 evaluation kit for the processor board. This board has a very good 1K monitor ROM, which I was loathe to discard. Output from this monitor is in the form of software-generated TTY serial data.

All was well while I was using a VDU board that accepted this TTY data. However, this board was on loan, and soon the time came for me to build my own VDU board. I decided that a VDU board that accepted data directly from the data bus was the only way to go, so I built up the board described by Don Alexander in the March 1977 issue of *73 Magazine* ("High Quality Display," p. 72). This performed very well, but there was still this basic incompatibility outlined above.

I/O Modification

I suppose the only final solution is to create a new monitor in EPROM memory, but an interim fix is possible. This solution, while implemented on an F8, is equally applicable to other processors that have an external interrupt capability. With this in mind, understand that the explanation that follows will be in general terms.

As you probably well know, a character in TTY format is preceded by a start bit that takes the output line low. Also, most external interrupt lines need to be taken low to generate an interrupt to the processor. What a happy coincidence this is!

By tying the output line to the interrupt line, an interrupt is generated every time the monitor attempts to output a character. At the time this start bit emerges, the character to be output is sitting waiting to be snatched up. (In the case of the F8 it is sitting in a scratchpad register.)

Apart from a few housekeeping chores, the interrupt service routine only needs to grip up this character and send it to the video output driver. A generalized flowchart is presented in Fig. 1. Since the F8 is somewhat of an orphan in the hobby field, I didn't supply the machine code, although I will if anybody wants it.

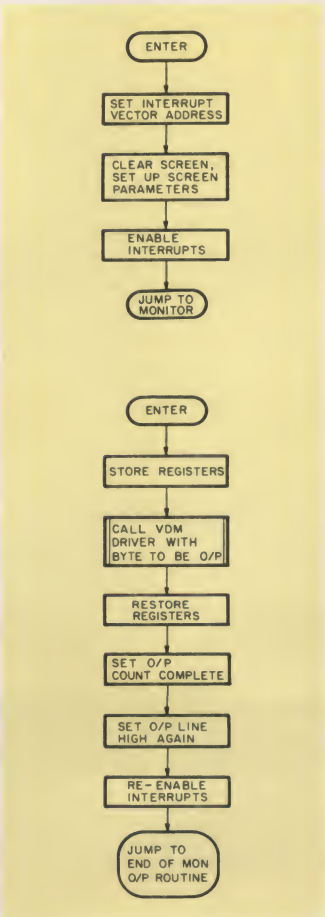


Fig. 1. Initialization and Interrupt Service routine flowcharts.

The only hardware required is a switch that switches the output line to the interrupt line. This must clearly be open if you are to continue to use the necessarily serial output for dumping programs to cassette.

My operating procedure is to load in the video driver from cassette (this driver will soon be in an EPROM) and then execute the initialize routine. This clears the screen, sets up the screen parameters and jumps to the monitor. This procedure is done "in the dark" as the screen is not available until this routine is executed.

Apart from this minor disadvantage, this scheme works well. There is no need to alter the output calls to the monitor as used in previously written programs, and new programs can call the monitor output routine as before.

Thus with one switch and a *little software*, you can make a very acceptable match between serial output and a parallel input video board. ■

Nerves

Just press a button—but do it at the right time!

Mark J. Borgerson
210 NW 11th St.
Corvallis OR 97330

In this article I'm going to tell you about a BASIC-language computer game that doesn't require you to know the difference between a phasor and a bagel and won't even require you to add two and two. All you really need is the ability to read the score and have enough dexterity to press a key on the keyboard . . . at the right time.

The game of Nerves is basically a test of your ability to judge short (1 to 8 seconds) time intervals. Since the game is so simple—almost trivial—it makes an excellent demonstration game for parties and group get-togethers where your guests are less-than-experienced computer hackers.

Even though the game is simple, it does have enough excitement built in to prove appealing to different types of people. As a result, this game has been played by more people at my parties than any other. In fact, in the 10 to 20 minutes I hope you will spend reading this article, I could probably teach your ten best friends to play the game—one at a time!

As I said, the object of this game is to judge a time interval selected by the computer. When you start the game the

Program A.

```
0001 REM THE GAME OF NERVES
0002 REM BY MARK BORGERSON
0004 RESTORE
0015 DATA 121,160,20,119,160,20,125,128
0016 DATA 4,42,10,122,160,20,38,240,122
0017 DATA 160,21,38,235,126,225,172
0018 DATA 0,0,50
0019 REM POKE IN MACHINE LANGUAGE ROUTINE
0020  A=40980
0025 FOR I=2 TO 25
0030 READ D
0035 POKE( A+I,D)
0040 NEXT I
0044 REM POKE IN STARTING ADDRESS FOR US
ER ROUTINE
0045 POKE( 103,160)
0050 POKE( 104,22)
0055 READ C1,C2,D1
0070 PRINT
0074 REM PRINT THE CURRENT STANDINGS
0075 PRINT "ME:";C1,"  YOU:";C2
0080 PRINT "*"
0084 REM GET A RANDOM FACTOR BETWEEN -50
 AND +50
0085  D0=100*RND(0)-50
0090  D1=D1+D0
0094 REM CHECK FOR TIME TOO SMALL
0095 IF D1<30 D1=D1-D0
0096 IF D1>255 D1=D1-D0
0099 REM POKE DELAYS INTO USER ROUTINE
0100 POKE( A+1, D1)
0105 POKE( A, RND(0)*250)
0110  Q=USER(0)
0114 REM FETCH REMAINING DELAY
0115  S=PEEK(A+1)
0120 IF S<>0 GOTO 140
0125 PRINT "  TOO SLOW!"
0130  C1=C1+50
0135 GOTO 155
0139 REM SPLIT 50 POINTS BETWEEN COMPUTER
  AND PLAYER
0140  S1=50*(D1-S)/D1
0145  C2=INT(C2+S1)
0150  C1=INT(C1+50-S1)
0154 REM CHECK FOR END OF GAME
0155 IF C2>500 GOTO 175
0160 IF C1<500 GOTO 70
0165 PRINT "I WIN!!!"
0170 GOTO 180
0175 PRINT "AW SHUCKS, YOU WIN."
0180 INPUT "DO YOU WANT TO PLAY AGAIN";Y$
0185 IF Y$="YES" GOTO 4
0190 END
```

computer will print the initial score and then print an asterisk. Then it will jump to a machine-language routine that decrements the time counter while waiting for any key on the keyboard to be pressed. When you press a key, control returns to the BASIC program, which computes the scores for the player and the computer.

A total of 50 points is awarded in each turn. The number of points you will get depends on what fraction of the computer's time interval you wait before pressing a key. If you wait 98 percent of the time interval, you will get 49 points. If your nerves are shot and you hit the key after only 5 percent of the time, you will get about two points, and the computer will get the other 48. There is a minor hitch, though—if you wait too long the computer will tell you that you were too slow and take all 50 points!

To add a little spice to the game and keep you guessing, the computer will change the time interval either up or down by as much as 20 percent after each turn. If you manage to accumulate 500 points before the computer, it will grudgingly admit defeat. If it beats you to 500, it will gloatingly announce its victory. As you can see from the brevity of these instructions, this game won't overburden your mental resources.

The game is also simple enough so that it should fit nicely into 8K of memory along with 8K BASIC. With a little ingenuity you might even be able to convert it to run in a smaller system—as long as you retain the ability to jump to a machine-language routine. As written now, the game does use some of the string-handling functions of SWTP 8K BASIC.

The Programs

Program A, the BASIC program for the game of Nerves, is very simple, really. The computer simply POKEs a number proportional to a 1 to 8 second delay time into memory location 40981 (A015 hex). Then the computer jumps to a machine-language routine that periodically decrements this delay counter while testing for an input from the keyboard. The machine-language routine is shown in Program B.

Lines 4 to 40 in Program A write the machine-language program into the 128-byte RAM associated with the MIKBUG ROM in my system. If your computer is not M6800-based or doesn't have this memory area available, you will have to rewrite Program B to match your system.

Be sure to put the routine someplace where it doesn't interfere with your BASIC interpreter. You will also have to figure out how to test for keyboard input on your system if you don't use the standard MIKBUG control interface at address 8004 (hex).

Now that I've given you a description of the game and how it works, I'll give you one last piece of advice . . . don't take this game too seriously! Losing the game of Nerves should not reflect adversely on your skills as a programmer or your general capabilities as an all-around good person. This is a game that could probably be automated and sold by a toy company for about $20 . . . so don't start kicking your thousand-dollar computer if you don't win the first two or three games. ■

```
ADDRESS   DATA    SOURCE CODE

A016      79 A014  ROLL   ROL $A014
A01A      76 A014         ROR $A014   Wasting Time
A01D      7D 8004         TST $8004   Test Keyboard
A020      2A 0A           BPL RETN    If active, return
A022      7D A014         DEC $A014   Decrement time waster
A025      26 F0           BNE ROLL    Not 0, loop back
A027      7A A015         DEC $A015   Decrement delay counter
A02A      26 EB           BNE ROLL    Not 0, loop back
A02C      7E E1AC  RETN   JMP $E1AC   Jump to MIKBUG input rtn
```

Program B. This is the machine-language routine that decrements the delay counter while waiting for an input from the keyboard.

Reader Service—see page 179

Taking AIM

Here's an entry from Rockwell International: the 6502-based AIM 65.

Kenny Lloyd
GSI Systems
223 Crescent St.
Waltham MA 02154

The AIM 65 from Rockwell International is a welcome new addition to the single-board microcomputer inventory. Based on the fast 6502, it has features and interfaces on-board that are well planned and useful. These include a small 20-column thermal printer, a 20-character alphanumeric display, a full keyboard, a computer-controlled dual-cassette interface, a TTY interface, an expansion area for static memory and read only memory (ROM), a powerful ROM monitor with mini-assembler, disassembler, cassette operating system and text editor.

Also included are two 44-pin connectors on board: one KIM-compatible expansion connector and one applications connector for TTY, cassette and parallel interfacing. A 6522 Versatile Interface Adapter (VIA) makes interfacing easier.

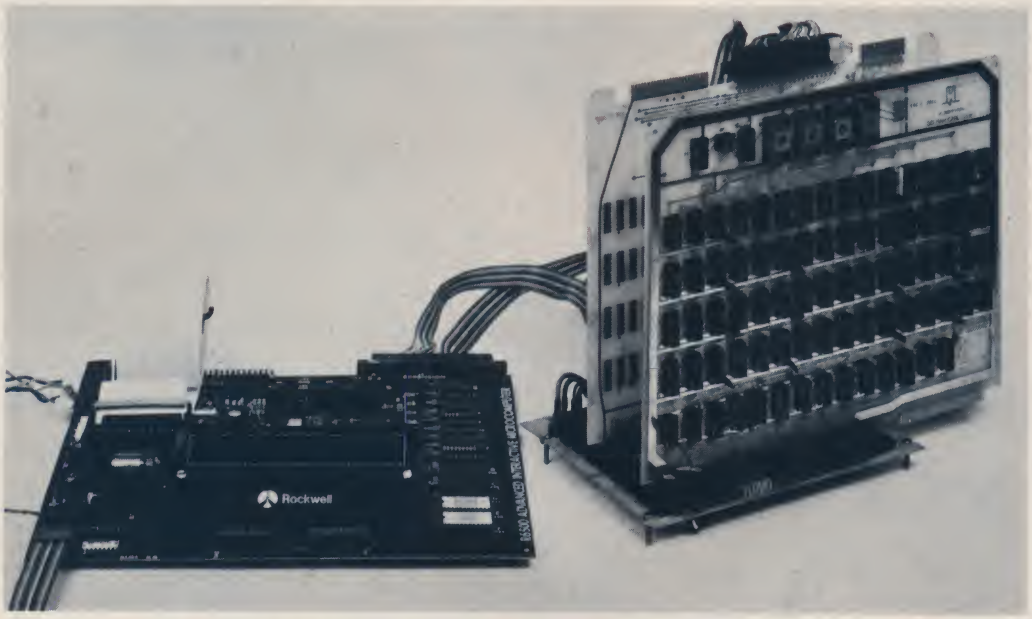
The AIM documentation consists of four well-bound paperback manuals and a large system schematic. No power supply is provided, however, nor any sort of video or graphics interface.

Priced at $375, the AIM 65 has features not available in other small microcomputer systems. Perhaps there is room for another 6502 system.

System Assembly and Power-up

The AIM arrived in a secure package, which included conductive foam on the underside of the printed circuit board to provide protection from static charges. The complete system consists of two separate modules—the keyboard and the PC board. The keyboard connects to the main board by a short, flat ribbon cable. Since there is no case, Rockwell has provided small self-adhesive plastic feet that support both modules. The AIM 65 user's guide contains helpful step-by-step assembly instructions with adequate drawings and diagrams.

Only two voltages are necessary to power the system: +5 V regulated at 2 A and +24 V unregulated at 2.5 A peak/.5 A average. The +24 V powers only the printer, so it is possible to run the AIM on a single 5 V supply without the printer. A heavy-duty terminal strip is provided at the left rear of the main board, thus allowing easy connection to the owner-provided power supply. The terminal strip also has connectors for +12 and −12 V dc, which provide the two 44-pin connectors with the extra voltages when needed for an interface. It took us at GSI Systems about ten minutes to unpack and connect the AIM. Upon original power-up, the display and printer indicated power-up reset by the sign-on message "Rockwell AIM 65."



The AIM main board and GSI 8K Static Memory Card. The flat ribbon on the left front of the AIM board is a longer cable to the keyboard (not pictured). The printer is smaller than a roll of paper. The memory card is Intel Multibus-compatible and has 4K of EAPROM (electrically alterable programmable read only memory).

The Keyboard, Printer and Display

The keyboard is a well-built, sturdy type conducive to fast and accurate touch-typing. The supplied ribbon cable that connects the keyboard to the master module should have been a little longer. We have inadvertently pulled the cable from the socket while moving

the modules. The keyboard has all the necessary keys for an uppercase-only system, including Escape and Delete and three user-defined function keys. A key labeled Print, when used simultaneously with the Control key, toggles the printer off and on. If the printer was off it is turned on, and vice versa.

At this time a printer-status message is displayed to indicate which of the two possible states the printer has entered—printer *down* or printer *up*. The keyboard is not decoded to ASCII before output to the system. The decoding occurs on the main module by a RAM I/O Interval Timer (RIOT), type R6532.

The printer is a 20-character-per-line dot-matrix thermal printer. A thermal printer actually burns the dots onto the paper to form alphanumeric characters and, therefore, requires special paper, which is available at $1.00 per roll. The paper is about the size of an adding-machine tape, and the characters appear in light blue color and can be difficult to read in a poorly lighted room. The printer is small and quiet, except when removing power from the system when it winds down, thus creating a sound like an electric motor losing speed. This is a small annoyance for a system full of so many other bonuses. Mounting the paper and feeding it to the printer is an easy task, and instructions are provided. The display is also 20 characters and is mounted at an angle making it easy to read. There are five four-digit 16-segment displays which allow full alphanumeric capabilities.

On-Board Memory

The AIM is supplied with 1K of on-board random access memory (RAM) in the form of two 2114s organized as 1K by 4-bit chips. The 1K is 1024 decimal, so two 2114s provide 1024 8-bit bytes. There are six empty RAM sockets, which allow a total of 4K bytes of memory on-board. The 6502 uses addresses $0000 to $00FF hexadecimal for registers and pointers that are normally called zero page. Addresses $0100 to $01FF hex are used for the stack and some I/O pointers. Maximum available system memory is 10K hex, or 40K decimal when you use external memory.

The expansion connector is supposedly KIM-compatible; therefore, adding memory to the AIM should not be much of a problem. We interfaced to Intel-compatible memory because it was available in the lab.

There are five 24-pin read only memory (ROM) sockets on board. Rockwell has chosen high-density ROMs that hold 4096 decimal bytes of code each. They are addressed from $B000 to $FFFF hex.

Two ROMs that contain the monitor, text editor, mini-assembler and other goodies are supplied (see the Monitor section, which follows).

A full assembler and an 8K BASIC interpreter are now available in ROM form.

ROM Monitor and Other ROM Goodies

Two read only memories on-board contain: (1) system monitor; (2) mini-assembler; (3) disassembler; (4) cassette operating system; (5) text editor.

This area of the AIM has impressed me the most. A lot of programming has been done by Rockwell to make programming for us as easy as possible. A Step mode executes one instruction and then allows for register trace, instruction trace and breakpoint examination. Separate single-letter initialized commands allow altering the index register, stack, program counter, accumulator and processor status words. Instructions can be entered by using standard 6502 mnemonics or by machine-language entry in hexadecimal. Programs can be disassembled from machine language into mnemonics with outputs to the printer and display. As many as three user-defined programs can be executed by the user-function keys, F1, F2 and F3, on the keyboard.

The text editor mentioned above can receive or store data from the keyboard or cassette, from paper tape or any device properly interfaced to the AIM.

```
<E>
EDITOR
FROM=200  TO=400

IN=
*HELLO KILOBAUD AND
*READERS EVERYWHERE
*
 HERE IS A SAMPLE OF
*THE AIM TEXT EDITOR
*USING AN UNMODIFIED
*TELETYPE AND THE
*INTERFACE DESCRIBED
*IN THE USERS
*MANUAL/
*FOLLOWING THESE LINES
*WILL BE A MNEMONIC
*ENTRY OF A TRIVIAL
*PROGRAM AND THEN A
*SHORT DISASSEMBLY.



<*>=220

<I>
 0220    LDA #00     A9 00
 0222    TAY         A8
 0223    TAX         AA
 0224    CMP (50),Y     D1 50
 0226    BEQ 0230     F0 08
 0228    INY         C8
 0229    BNE 0224     D0 F9
 022B    BRK         00
 022C    *=0230
 0230    BRK         00
 0231
<K>*=220
/
 0220 A9 LDA #00
 0222 A8 TAY
 0223 AA TAX
 0224 D1 CMP (50),Y
 0226 F0 BEQ 0230
 0228 C8 INY
 0229 D0 BNE 0224
 022B 00 BRK
 022C 53 ???
 022D 20 JSR 2041
 0230 00 BRK
```

Sample output from the AIM text editor.

The editor is primarily line oriented, but with a maximum of 20 characters per line this is a minor burden.

In fact, just having a text editor in a system of this price is a bit of luxury. The editor, by default, can determine the available system memory and use all of it (except for page zero and page one), or the user can define the allowed buffer space.

The cassette operating system is interactive. Files can be recorded with names of up to five characters on either of two cassette recorders that can be turned on and off by the computer. When a file is loaded, a sequential search by file name is done automatically until the correct file is found and loaded. This cassette operating system is a great step forward for the small-system users who probably will never have a disk drive. We did, however, have some noteworthy problems with the cassette interface.

Cassette Interface

There are two on-board cas-

sette interfaces that can be controlled directly from the keyboard, or you may choose to operate the cassette-players manually. We were unable to find in the manuals a Rockwell-recommended cassette recorder, so we used the Panasonic RQ-2309 and the Apple-recommended Panasonic RQ-309. The user's manual does contain a program for testing the "write to" and "read from" functions. This program displays a Y or an N to indicate whether proper reading has occurred. The program listing has a few mistakes, but we fixed them (see the corrected listing). When properly entered, this program is useful for a quick test.

A whole chapter in the user's manual is devoted to all areas of cassette and Teletype interfaces, including proper connections for cassettes that might be grounded differently. But even with all of this information we had trouble obtaining a reliable cassette operation.

We purchased two AIM 65 systems in two days, and both of them required much attention before satisfactory cassette operation was achieved. (On the positive side, we should say that we bought the second system because we liked the first one.)

The first area of difficulty was the course-adjustment VR1. The voltage on both boards was out of tolerance. According to the user's guide it should have been within one-tenth of a volt of two and a half volts.

The second difficult area was harder to find but easy to remedy. The AIM writes data out to the cassette in blocks of 80 characters. In between the blocks is an inter-record gap of characters (ASCII 16), which is four times the amount contained in memory location $A409.

The assembly comment in the monitor listing for address $A409 is "Timing Gap Between Blocks." Eric Johansson of the GSI R and D staff found that operation became reliable when the inter-record gap was increased. He changed the $08 in location $A409 to $20. He also found differing reliability in the same system when the remote-control interface was not used. That is, it worked better using one cassette recorder manually than when using the same system and recorder under remote control. We also found that removing the ac line cord and operating on batteries improved the cassette operation in some instances. Obviously some hacking around was necessary for us.

```
0300    JSR F21D    20 1D F2
0303    JSR F24A    20 4A F2
0306    JMP 0303    4C 03 03
0309    *=0310
0310    LDX #00     A2 00
0312    LDA #CE     A9 CE
0314    JSR EF7B    20 7B EF
0317    JSR EDEA    20 EA ED
031A    LDX #00     A2 00
031C    LDA #D9     A9 D9
031E    JSR EF7B    20 7B EF
0321    JSR EE29    20 29 EE
0324    CMP #16     C9 16
0326    BEQ 0321    F0 F9
0328    BNE 0310    D0 E6
</> 0309 EA EA EA EA
</> 030D EA EA EA
<K>*=300
0300 20 JSR F21D
0303 20 JSR F24A
0306 4C JMP 0303
0309 EA NOP
030A EA NOP
030B EA NOP
030C EA NOP
030D EA NOP
030E EA NOP
030F EA NOP
0310 A2 LDX #00
0312 A9 LDA #CE
0314 20 JSR EF7B
0317 20 JSR EDEA
031A A2 LDX #00
031C A9 LDA #D9
031E 20 JSR EF7B
0321 20 JSR EE29
0324 C9 CMP #16
0326 F0 BEQ 0321
0328 D0 BNE 0310
```

Corrected test program.

The only problem we have encountered using the AIM 65 has been in the cassette area, but it is a real plus for a small system to have dual remote-controlled cassette interfaces.

Zero Page, Stack and the 6532

The 6532 is a powerful I/O interface chip with interval timer and two software-controlled 8-bit data ports. Also on the chip are 128 bytes of static RAM, which is used by the AIM monitor for storage of keyboard, printer and tape variables, monitor registers and a zero-page simulator. This RAM is addressed at $A400 to $A4FF and does not interfere with precious page zero or RAM available for programs. When the text editor is not being used, virtually all of the zero page is available to the programmer.

The stack in 6502 systems begins at $01FF and works down toward $0100. Because it is rare that the stack ever uses the lower half of page one, the AIM monitor uses that area—$0100 to $016F—for the disassembler and assembler, I/O handlers and breakpoints. The use of the 6532 RAM and lower part of the stack area allows clean access to contiguous memory from $0200 to $9FFF with most of zero page available.

Documentation

Congratulations to Rockwell. Rare it is indeed that a recently available small system arrives with such complete and easy-to-read manuals. Two of the four well-bound manuals are nearly identical copies of the MOS 6500 hardware and programming manuals. The Rockwell programming manual explains the addressing modes and registers and flags of the 6500 series microprocessors. Another manual is a complete, well-commented, monitor listing that includes headings for each function.

The fourth manual, the user's guide, covers all topics peculiar to the AIM 65, such as instructions for use of all monitor commands, memory map, keyboard interface and VIA interface. This last manual contains a few errors and, unfortunately, most of them occur in the program listings.

Also provided with the AIM are two handy-size reference cards. The AIM 65 Summary Card has a complete list of all monitor commands as well as a list of monitor subroutines that might be used often. The R6500 Microprocessor Programming Reference Card contains everything a programmer might need to reference including addressing modes, hexadecimal and decimal conversion, relative branch tables, ASCII table and register diagram. The documentation package is impressive.

Conclusion

We have here a single-board system with an alphanumeric display. It needs a power supply but has a nice little *printer*. An assembler and BASIC are available as options to add to the fine monitor. A 20 mA Teletype interface and a cassette interface are on-board. It can read and write KIM-compatible cassettes and has a cassette operating system. On-board memory is expanded to 4K, and a powerful I/O chip is provided for further expansion to any peripheral. The system is well documented. The AIM 65 is quite a lot of little system. ■

Reader Service—see page 179

a PERCOM SAMPLER

For your SS-50 bus computer — the CIS-30+

- Interface to data terminal and *two* cassette recorders with a unit only 1/10 the size of SWTP's AC-30.
- Select 30, 60, or 120 bytes per second cassette interfacing, 300, 600 or 1200 baud data terminal interfacing.
- Optional mod kits make CIS-30+ work with *any* microcomputer. (For MITS 680b, ask for Tech Memo TM-CIS-30+—09.)
- KC-Standard/Bi-Phase-M (double frequency) cassette data encoding. Dependable self-clocking operation.
- Ordinary functions may be accomplished with 6800 Mikbug™ monitor.
- Prices: Kit, $79.95; Assembled, $99.95.

Prices include a comprehensive instruction manual. Also available: Test Cassette, Remote Control Kit (for program control of recorders), IC Socket Kit, MITS 680b mod documentation, Universal Adaptor Kit (converts CIS-30+ for use with any computer).

MIKBUG® Motorola, Inc.

In the Product Development Queue . . .

Coming PDQ. Watch for announcements.

6809 Processor Card — With this SS-50 bus PC board, you'll be able to upgrade with the microprocessor that Motorola designers describe as the "best 8-bit machine so far made by humans."

The Electric Crayon™ — This color graphics system includes its own μP and interfaces to virtually any microcomputer with a parallel I/O port.

Printer Interface — For your TRS-80™. Interface any serial RS232 printer to your TRS-80™ with this system.

™ELECTRIC WINDOW, ELECTRIC CRAYON, Pilon-30 and Pilon-10 are trademarks of Percom Data Company, Inc.
TRS-80 is a trademark of Tandy Corporation and Radio Shack which has no relationship to Percom Data Company

Orders may be paid by check or money order, or charged to Visa or Master Charge credit account. Texas residents must add 5% sales tax.

For your data storage — Pilon-30™ and Pilon-10™ data cassettes

- Orders-of-magnitude improvement in data integrity over ordinary audio cassettes.
- Pilon-coated pressure pad eliminates lint-producing felt pad of standard audio cassettes.
- Smooth pilon coating minimizes erratic tape motion.
- Foam pad spring is energy absorbing. Superior to leaf spring mounted pad which tends to oscillate and cause flutter.
- Five-screw case design virtually precludes deformation during assembly.
- **Price: $2.49.**

For your S-100 computer — the CI-812

- Both cassette and data terminal interfacing on one S-100 bus PC board.
- Interfaces *two* recorders. Record and playback circuits are independent.
- Select 30, 60, 120, or 240 bytes per second cassette interfacing, 110 to 9600 baud data terminal interfacing.
- KC-Standard/Bi-Phase-M (double frequency) encoded cassette data. Dependable self-clocking operation.
- Optional firmware (2708 EPROM) Operating System available.
- Prices: kit, $99.95; assembled, $129.95.

Prices include a comprehensive instruction manual. In addition to the EPROM Operating System, a Test Cassette, Remote Control Kit (for program control of recorders), and an IC Socket Kit are also available.

CASSETTE SOFTWARE

For 8080/Z-80 μCs . . .

BASIC ETC — Developed by the co-authors of the original Tiny BASIC, BASIC ETC is easy to use yet includes commands and functions required for powerful business and scientific programs as well as for hobby applications. 9.5K bytes of RAM. 1200-baud cassette and 42-page user's manual $35.00

Cassette Operating System — EPROM (2708) COS for the Percom CI-812 dual peripheral interfacing PC card .. $39.95

If you're programming on a 6800 μC, you'll want these development and debugging programs written by Ed Smith of the Software Works:

Disassembler/Source Generator — Disassembles SWTP Resident Assembler, TSC Mnemonic Assembler/Text Editor or Smoke Signal Mnemonic Assembler/Text Editor and produces compacted source code suitable for re-editing. Prints or displays full assembly-type output listing. 4K bytes of RAM.
(Order M68SG) $25.00

Disassembler/Trace — Use to examine (or examine and execute) any area of RAM or ROM. "Software-single-step" through any program, change the contents of CPU or memory location at any time, trace subroutines to any depth. 2.3K bytes of RAM.
(Order M68DT) $20.00

Support Relocator Program — Supplied on EPROM, this program relocates a program in any contiguous area of RAM or ROM to anywhere in RAM. Use to assemble and test programs in RAM, adjust programs for EPROM operating addresses and then block move to your EPROM burner address. 952 bytes of RAM. Loads at hex 1000.
(Order M68EP) $20.00

Relocating Assembler & Linking Loader (M68AS) $50.00

Relocating Disassembler & Segmented Source Text Generator (M68RS) $35.00

Americana Plus — 14 tunes for the Newtech Model 68 Music Board in machine language ready to load and run. Cassette compatible with Percom CIS-30+ and SWTP AC-30. Order MC-1SW .. $15.95

HARDWARE

Newtech Model 68 Music Board — Produces melodies, rhythms, sound effects, morse code, etc. from *your* programs. Includes manual with BASIC for writing music scores and assembly language routine to play them. Installs in SWTP I/O slot. Assembled & tested $59.95

The Percom ELECTRIC WINDOW™ — Memory-resident and programmable, this video display character generator board for your SS-50 bus displays up to 24 80-character lines. Features dual character generators, dual-intensity high-lighting. One programmable register controls scrolling. Compatible with standard video monitors $249.95

SS-50 Prototype Cards:
Large card (up to 70 40-pin ICs) $24.95
I/O size card $14.95

PERCOM

PERCOM™ *'peripherals for personal computing'*

PERCOM DATA COMPANY, INC. ✓P59
211 N. KIRBY • GARLAND, TX. 75042

To order products or request additional literature, call Percom's toll-free number: 1-800-527-1592. For detail technical information call (214) 272-3421.

✓ Reader Service—see page 179

For your SWTP 6800 Computer . . .

PERCOM's™ FLOPPY DISK SYSTEM

the

LFD-400

Ready to plug in and run the moment you receive it. Nothing else to buy, no extra memory. No "booting" with PerCom MINIDOS-PLUSX™, the remarkable disk operating system on EPROM. Expandable to either two or three drives. Outstanding operating, utility and application programs.

To order or request literature call Percom toll-free 1-800-527-1592.

only **$599.95**

fully assembled and tested shipping paid

PERCOM™

PERCOM DATA COMPANY, INC.
211 N. Kirby Garland, TX 75042
(214) 272-3421

For the low $599.95 price, you not only get the disk drive, drive power supply, SS-50 bus controller/interface card, and MINIDOS-PLUSX™, you also receive:
• an attractive metal enclosure • a fully assembled and tested interconnecting cable • a 70-page instruction manual that includes operating instructions, schematics, service procedures and a complete listing of MINIDOS™ • technical memo updates — helpful hints which supplement the manual instructions • a 90-day limited warranty.

SOFTWARE FOR THE LFD-400 SYSTEM

Disk operating and file management systems

INDEX™ The most advanced disk operating and file management system available for the 6800. INterrupt Driven EXecutive operating system features file-and-device-independent, queue-buffered character stream I/O. Linked-file disk architecture, with automatic file creation and allocation for ASCII and binary files, supports sequential and semi-random access disk files. Multi-level file name directory includes name, extension, version, protection and date. Requires 8K RAM at $A000. Diskette includes numerous utilities $99.95

BASIC Interpreters and Compilers

SUPER BASIC A 10K extended disk BASIC interpreter for the 6800. Faster than SWTP BASIC. Handles data files. Programs may be prepared using a text editor described below $49.95
BASIC BANDAID™ Turn SWTP 8K BASIC into a random access data file disk BASIC. Includes many speed improvements, and program disk CHAINing $17.95
STRUBAL+™A STRUctured BAsic Language compiler for the professional programmer. 14-digit floating point, strings, scientific functions, 2-dimensional arrays. Requires 20K RAM and Linkage Editor (see below). Use of the following text editors to prepare programs. Complete with RUN-TIME and FLOATING POINT packages $249.95

Text Editors and Processors

EDIT68 Hemenway Associates' powerful disk-based text editor. May be used to create programs and data files. Supports MACROS which perform complex, repetitive editing functions. Permits text files larger than available RAM to be created and edited $39.95

TOUCHUP™ Modifies TSC's Text Editor and Text Processor for PerCom disk operation. ROLL function permits text files larger than available RAM to be created and edited. Supplied on diskette complete with source listing $17.95

Assemblers

PerCom 6800 SYMBOLIC ASSEMBLER Specify assembly options at time of assembly with this symbolic assembler. Source listing on diskette $29.95
MACRO-RELOCATING ASSEMBLER Hemenway Associates' assembler for the programming professional. Generates relocatable linking object code. Supports MACROS. Permits conditional assembly $79.95
LINKAGE EDITOR – for STRUBAL+™ and the MACRO-Relocating assembler $49.95
CROSS REFERENCE Utility program that produces a cross-reference listing of an input source listing file $29.95

Business Applications

GENERAL LEDGER SYSTEM Accommodates up to 250 accounts. Financial information immediately available — no sorting required. Audit trail information permits tracking from GL record data back to source document. User defines account numbers $199.95
FULL FUNCTION MAILING LIST 700 addresses per diskette. Powerful search, sort, create and update capability $99.95
PERCOM FINDER™ General purpose information retrieval system and data base manager $99.95

™ trademark of PERCOM Data Company, Inc
™ trademark of Hemenway Associates Company

Now! The LFD-800 and LFD-1000. Add one, two or three LFD-800 drives and store 200K bytes per drive on-line. Add one or two (dual-drive) LFD-1000 units and store 800K bytes per unit on-line. Complete with interface/controller, DOS, cable & manuals. **Two-drive** systems: LFD-800 — $1549; LFD-1000 — $2495.

✓P7 **PERCOM *'peripherals for personal computing'***

How to Silence a Noisy Computer

Electronic noise can cause a host of glitches in digital circuits. Here's what some of the chip manufacturers have to say about the problem . . . and what to say about its cures.

Chuck Gahan
12781 Taylor St.
Garden Grove CA 92645

In the present day and age of home-brew computers, there are many newcomers to the world of digital electronics. With all the kits available, many first-time computerniks are trying to economize and put things together for themselves. In addition, there are people with varying degrees of logic experience who are designing and building their own interfaces for a multitude of peripherals.

Many are probably discouraged, and justly so, with their own initial efforts of building interfaces from scratch because of problems associated with intermittent electronic noise. It is also a good bet that a number of kits being marketed are sold without proper noise protection.

Noise problems are something that many design engineers of micro/mini-computer systems are plagued with, and on many first attempts at a design, noise considerations are overlooked. So it is not there simply to intimidate the novice designer.

Weik's *Standard Dictionary of Computers and Information Processing* defines noise as:

"1. Random variations of one or more characteristics of any entity, such as voltage, current, sound or data. Noise is generally unwanted, although some types of noise are used. In the case of data, the noise, appearing as meaningless extra bits, characters or words, must be removed from the data at the time they are used.

"2. In communications, the sum of all unwanted or disturbing power introduced into a communications system from any sources, such as crosstalk, power induction, atmospheric conditions or electronic circuit components.

"(Synonymous with *static*.)"

Noise can cause a wide range of problems, most relating to data transfers. The garbage and garble that appear within your system, especially your brand-new interface board, may be because you haven't properly filtered the board against resonant and switching frequencies that may interfere with the operating frequency of the board.

The solution to this is decoupling, or bypassing, those unwanted frequencies to ground. Information regarding decoupling is rather sketchy, misleading or nonexistent, because each manufacturer has his own set of guidelines, and those that are supplied will differ.

Take a look at what some of the chip manufacturers are telling us (and most of them hide these suggestions deep within the text of their chip data books; some make no mention at all in the printed material that normally would be available to the average hobbyist):

Signetics:

Decoupling. "Current spiking and Vcc noise are generated internally within the circuits due to the overlap in conduction of the upper and lower transistors in the totem-pole outputs, the difference in Icch and Iccl and the changing of load capacitances. The power-supply decoupling rules for standard TTL apply to low-power Schottky also (i.e., 0.01 uF per synchronously driven gate and at least 0.1 uF per 20 gates regardless of synchronization).

On-board Regulation. "In most digital systems, there is a large current requirement, and the current supplied usually comes from a main supply. TTL logic tends to generate current spikes during switching due to the overlap in conduction of both the upper and lower transistors thus creating Vcc noise. An on-board voltage regulator could be used not only to regulate the power supplied to the circuits on the board, but also to isolate the noise otherwise propagated to the rest of the system. Systems designed using this technique would not need tight regulation on the main supply."

ITT:

"External inputs should be brought on the printed-circuit connector at right angles to the other wiring, the printed circuit itself being laid out to ensure the least coupling between input and other connections. Decouple every ten gates or their equivalent MSI (and LSI) functions with 0.01 uF to 0.1 uF capacitors of rf rating."

National:

"Vcc and ground wiring should conform to good high-frequency standards so that switching transients on Vcc and ground leads do not cause interaction . . . use of a 0.01 to 0.1 uF capacitor between Vcc and ground located near (the chip) is recommended.

"Pointing out . . . these transient currents and their magnitude demonstrates the need for using bypass capacitors . . . If there is significant inductance in the Vdd, Vss, and/or Vbb lines, serious voltage transients will result unless sufficient bypass capac-

itors are used. Requirements vary with actual application, but 0.1 uF, from Vdd to Vss and from Vdd to Vbb for every other (chip), is usually sufficient ... Since bypass capacitors are attempting to defeat line resistance and/or inductance, it is important to place them physically as close to the (chips) they are intended to bypass. Using one centrally located capacitor is effective for decoupling transients generated on one board from getting into another board, but usually will not help decouple transients internal to the board."

Intel:

"Power distribution is ... important. Although most static MOS and bipolar devices draw relatively constant current from the power supplier, MOS output circuits, particularly those of p-channel MOS, can contribute significant transients to power supplies. Bipolar devices with relatively low pull-up resistors and those with three-state outputs can also induce significant transients. To ensure proper operation of both memory and the surrounding circuitry, power supplies should be adequately bypassed. Ceramic capacitors in the .001 to .05 uF range are recommended, with one capacitor being used for every one to ten parts."

Mostek:

"... Proper power distribution and bypassing techniques are required to maintain system power-supply noise levels at an acceptance level. Low-inductance supply lines for Vdd and Vss are desirable. A minimum of one 0.01 uF, low inductance, bypass capacitor per two ... devices and one 6.8 uF per eight ... devices on each of the Vdd and Vbb supply lines is desirable."

As you can see, there is a considerable difference in opinion as to just what comprises an adequately decoupled board, but based on experiences, I recommend the following:

1. You can't have too much decoupling, so buy your 0.01 uF, 50 V, +80%, -20%, Z5U-type ceramic capacitors by the pound.

2. Add one of those capacitors to every chip on the board that drives more than one circuit. Mount them between all logic voltages used on the board and ground, and with the capacitor as physically close to the chip as possible.

3. Use one 6.8 uF, 50 V electrolytic capacitor for every eight chips on the board. A smaller voltage value may be used.

4. Use one 0.1 uF, 50 V tantalum capacitor alongside every 6.8 uF.

5. Use one 20 uF, 10 V, 10 percent electrolytic capacitor across the +5 V and ground near the input to the board.

6. In order for decoupling to work, the common mode noise between ground and power must be kept to a minimum, as decoupling mainly affects differential power noise. This means that the power supply leads should be as large as possible.

7. Voltage buses should be as wide and as thick as possible. The extra metal will present lower impedance to the power supply. Also, voltage bus runs should be kept separated; long, parallel land patterns of voltage and ground tend to act as large plates of a capacitor (in this case, undesirable). If they must cross each other (on opposite sides of the board), they should do so at right angles.

8. On-board regulation circuitry is up to the discretion of the builder.

My thanks to Joe Lombardo, an electronics engineer at Hendrix Electronics, Manchester NH, for technical assistance. ■

✓ *Reader Service—see page 179*

Tom Hayek
723 Hialeah Dr.
Racine WI 53402

PET Wrap-up

If your PET is feeling the memory crunch, haul out the wire-wrap tool and relieve the shortage.

After using the Commodore PET for several months, I came to the conclusion that it would be advantageous at times to have more than 8K of memory for such things as a text editor, larger programs in BASIC, storage of large amounts of data for later storage on tape, etc. Here is a description of an 8K RAM expansion that you can add to your PET for about $160.

Since the PET became available late in 1977, one of the many questions asked has been, "Where can I get more RAM to plug in and where do I plug it in?" There are many good sources for S-100 RAM boards, but you won't find a place to plug them into a PET without purchasing an S-100-to-PET interface adapter. These are now available from several sources. Several manufacturers have also announced RAM expansion for the PET. Although PET does not have an S-100 bus, it does have four external ports available.

PET's Ports

One of the PET's interface connectors is designed to conform to the IEEE 488 bus standard. This bus system was designed to standardize and simplify the interconnection of peripheral devices on a common bus. Any device can talk or listen to any other device on the bus as long as it is equipped with 488 interface logic. Voltmeters, scopes, waveform generators, plotters and other equipment are being produced with this interface for control.

Another port is a typical 8-bit parallel interface with two additional bits that can be used for control signals. Also on this same connector are signal outputs for connecting a remote monitor, output signals from the built-in and external cassette recorders and provisions for the diagnostic test system.

A third port is the second cassette recorder I/O. Commodore does have a recorder available for about $100; it plugs into this port ready to work.

The final port is the one of interest for memory expansion interfacing. This is a dual 40-contact, card-edge connection. Fig. 1 shows the pin-out for the expansion port and lists a mating connector.

Expansion Port Details

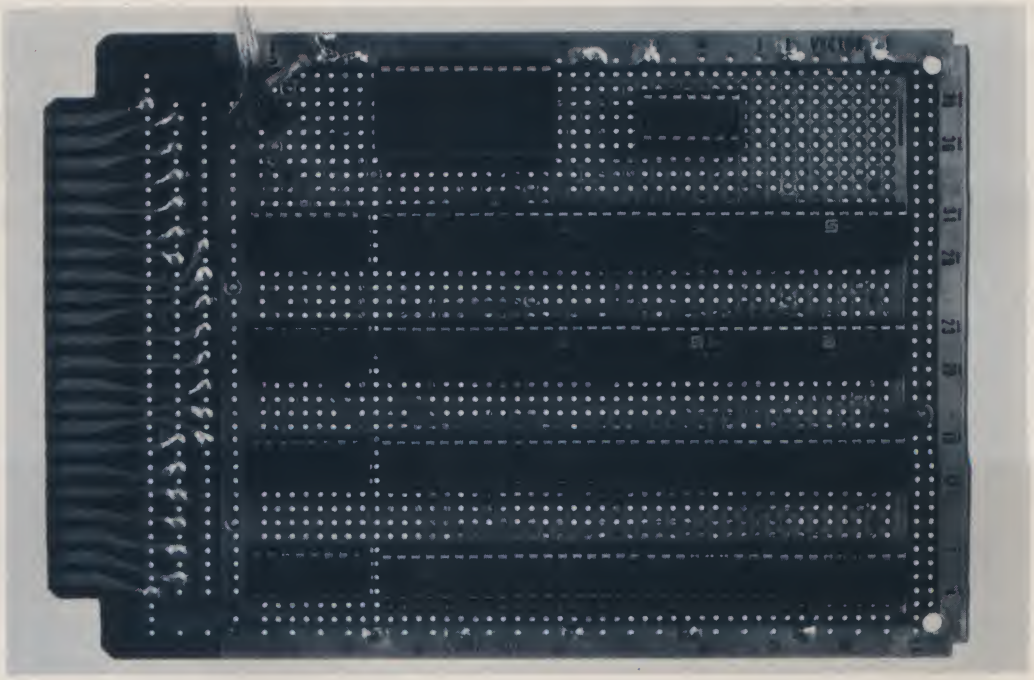
Address bus lines A0 through A11 are brought out to this port. The upper four bits (A12 through A15) are internally decoded by the PET's logic and brought out as 4K block select lines, $\overline{SEL}$1 through $\overline{SEL}$9, and $\overline{SEL}$ A and B. Each of these lines respectively selects a contiguous 4K block of memory in the PET's memory map. A 4K block is selected when the respective $\overline{SEL}$ line goes from a logic 1 to a logic 0.

Other lines brought out to this connector are: RES (reset), IRQ (interrupt request), BØ2 (phase 2), R/W (read/write) and the 8-bit data bus labeled BD0 through BD7. Of these, we will use the data bus lines and the R/W line.

Memory Chip Selection

There are scores of ICs to choose from when you design a RAM memory system. You must analyze the system requirements: speed, power, timing, interface problems, etc. Select the RAM that will best meet the requirements and be easy to interface and cost effective.

I chose the 2114 RAM series, specifically the 2114L-3, for several reasons. The 2114 is organized as 1K × 4 static RAM and will interface easily in the design. Also, the 2114 is widely used commercially and is readily available from many of the advertisers in *Kilobaud MICROCOMPUTING*. The price varies



Top view. The author's version was wire-wrapped on a Vector 4112-4 wire-wrap board. Power supply connection can be seen in lower right corner. (Photo by Al Spiroff)

from about $8 to $11, depending on the speed and power version. The 2114L-3 is a low-power version with 350 ns cycle time. The standard version will also work in this design—drawing about 1.1 A versus 800 mA for the low-power versions per 8K of RAM.

The Circuit

Fig. 2 shows the schematic diagram of the 8K expansion. The data bus lines are buffered by IC3 and IC4 (8T26). These are bidirectional buffers controlled by the gated R/W line. When the R/W line is a logic 1, signal flows from the expansion board to the PET. Signal flow is from the PET to the expansion board if R/W is a logic 0. The R/W line and the address bus lines are buffered by IC1 and IC2 (8T97).

IC5 (74LS154) is a four-line to 16-line decoder. Its function here serves to decode a 4K block select and each 1K within the block. Since the 2114 is organized as 1K × 4, a pair must be enabled for 1K of 8-bit words addressed by A0 through A9. Therefore, the combination at the input of IC5, $\overline{SEL}2$, $\overline{SEL}3$, A10 through A11 determines which pair of 2114s will be selected by outputting a logic 0 to the pair's CS (chip select) pins. ($\overline{SEL}1$ is not used because it decodes a 4K block in the PET's internal 8K memory.)

Thus we are using eight consecutive outputs of the 16 possible. These are the outputs that are a logic 0 when the highest weighted inputs ($\overline{SEL}2$ and $\overline{SEL}3$, in this case) are either a logic 1 and a logic 0 or a logic 0 and a logic 1, respectively.

The function of IC6 is to keep the PET from reading or writing data to the expansion when that portion of memory is not addressed. It does this by sensing the block select lines and gating the R/W line through only when one of the lines is a logic 0. Transistor Q1 serves as an inverter to offset the inversion of IC6.

Although A10, A11, $\overline{SEL}2$ and $\overline{SEL}3$ are not buffered on the expansion board, they are not heavily loaded and will operate satisfactorily if no additional loads are placed on them.

Construction

The photos show my construction on a wire-wrap board. Laying out and making a PC board for the expansion is a time-consuming and tedious job. Unless you plan to make several boards, wire wrapping is the way to go. Using pre-cut and stripped wire takes the drudgery out of the job. Total assembly time of the board is about four hours. One- and two-inch wire lengths (insulation length) were mostly used, as well as a few three-inch lengths.

The Vector 4112-4 wire-wrapping board seems perfect for the job. A ground-plane construction is furnished on the top of the board, and supply bus lines are conveniently run between the rows of IC pads on the bottom. The ends of these bus lines should be tied together to help prevent noise on the supply bus. A heavier strip

```
10  N=0
20  I=2↑N
30  PRINT I
40  FOR J=8192 TO 16383
50  POKE J,I
60  IF PEEK (J)<>I THEN 110
70  NEXT J
80  N=N+1
90  IF I<128 THEN 20
100 GOTO 200
110 K$=STR$(INT((J-7168)/1000)+6)
120 X=15:Z=240:A$="A":B$="B"
130 IF I>8 THEN X=240:Z=15:A$="B":B$="A"
140 IF (X AND PEEK(J))<>I THEN PRINT"PROBLEM WITH IC " K$A$
150 IF (Z AND PEEK(J))<>0 THEN PRINT"PROBLEM WITH IC " K$B$
200 END
```

Memory-test program. This BASIC program will test each bit position in all the 2114s. If there is a problem the program will stop, giving the IC location by number of the schematic.

A1	A0
A2	A1
A3	A2
A4	A3
A5	A4
A6	A5
A7	A6
A8	A7
A9	A8
A10	A9
A11	A10
A12	A11
A13	NC
A14	NC
A15	NC
A16	$\overline{SEL}1$
A17	$\overline{SEL}2$
A18	$\overline{SEL}3$
A19	$\overline{SEL}4$
A20	$\overline{SEL}5$
A21	$\overline{SEL}6$
A22	$\overline{SEL}7$
A23	$\overline{SEL}9$
A24	$\overline{SEL}A$
A25	$\overline{SEL}B$
A26	NC
A27	$\overline{RES}$
A28	$\overline{IRQ}$
A29	$\overline{B02}$
A30	$\overline{R/W}$
A31	NC
A32	NC
A33	BD0
A34	BD1
A35	BD2
A36	BD3
A37	BD4
A38	BD5
A39	BD6
A40	BD7

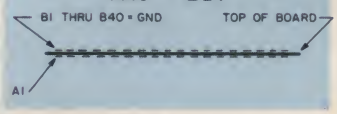
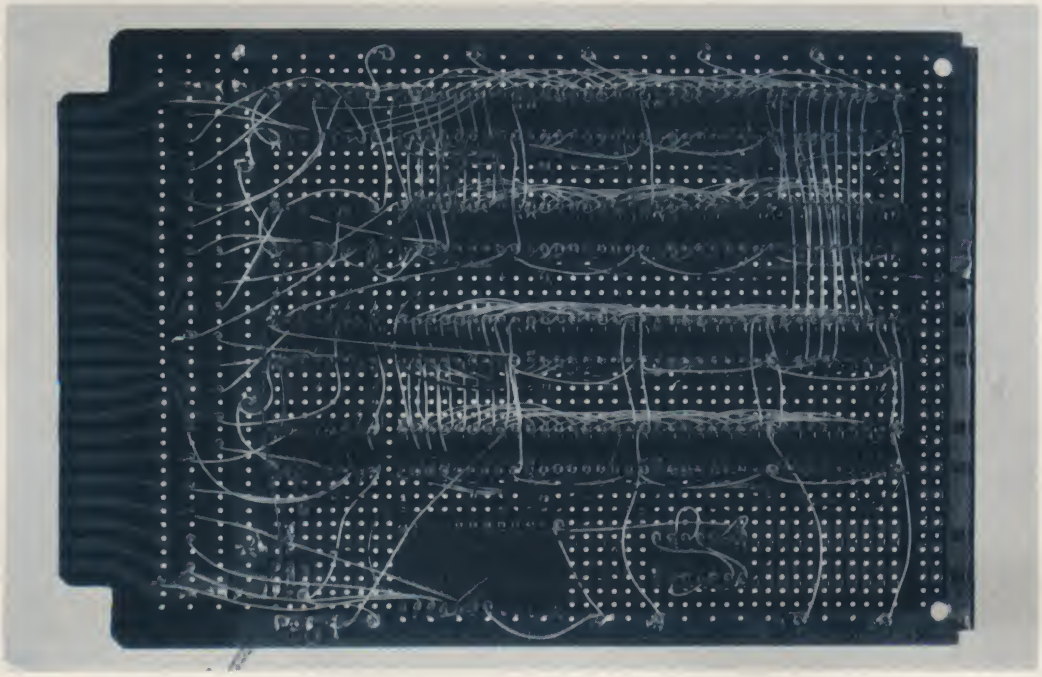
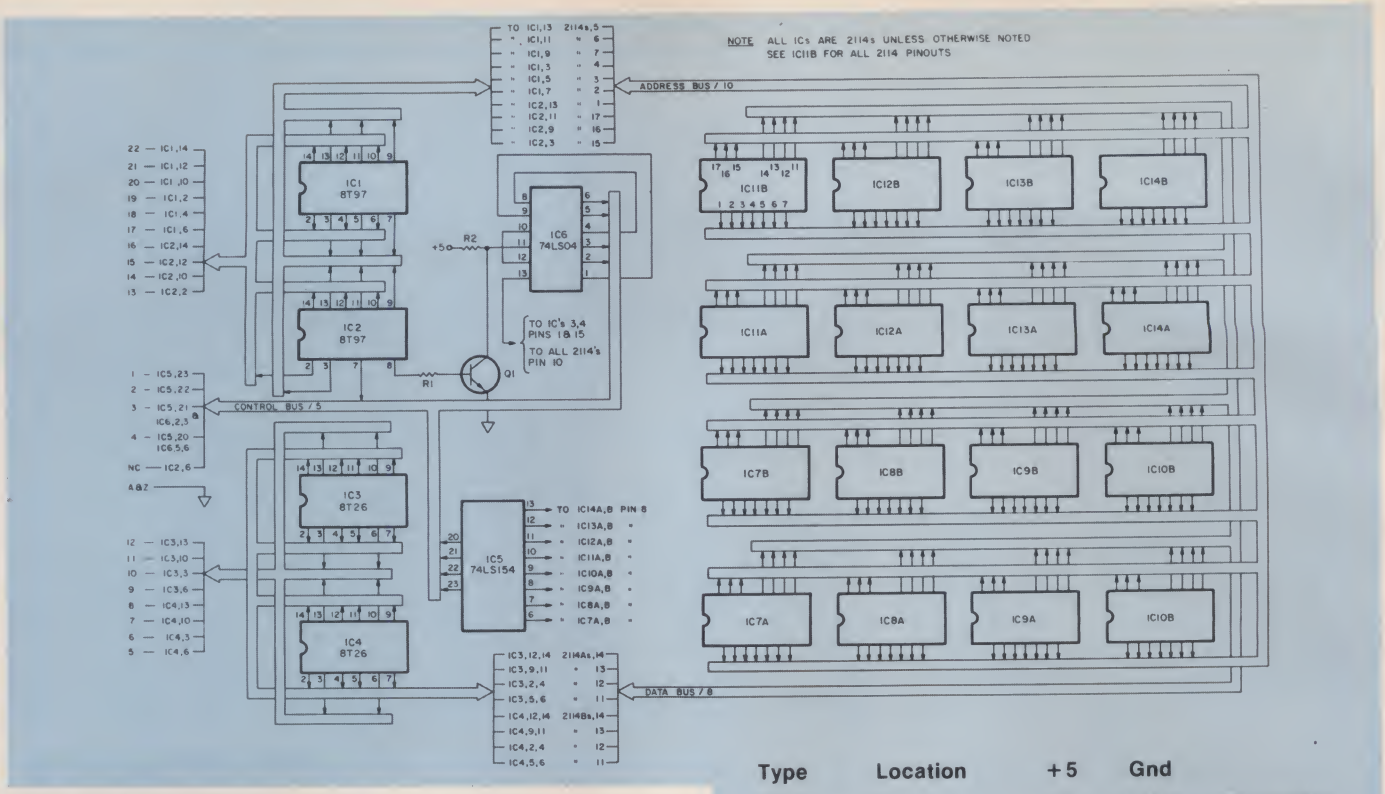


Fig. 1. PET's expansion port. PET's memory expansion port is a double-row, 40-pin, .1 inch spacing edge connection. Suggested mating connectors are: Cinch 251-40-30-410, Viking 3KH40/1JN5 or equivalent.



Bottom view. Wire-wrapping simplifies assembly. For further ease of assembly use precut and stripped wired. Keep wires short and direct.



Type	Location	+5	Gnd	
8T97	IC1, IC2	16	1,15,8	Q1-2N3904
8T26	IC3, IC4	16	8	R1-18k, ¼W
74LS154	IC5	24	12,18,19	R2-4.7k, ¼W
74LS02	IC6	14	7	
2114	IC7 A&B thru IC14 A&B	18	9	

Fig. 2. Schematic. Keep lead lengths short and as direct as possible to avoid noise problems. Wire wrapping on the Vector 4112-4 wire-wrap board simplifies construction, and errors are easy to correct.

around the edge on the underside serves as the common bus. The sockets are held in by soldering the four corner pins to the tinned-foil IC pads.

The +5 V supply line should be bypassed in about four places. These should be distributed around the board—two, one on each end, at the heavy positive supply bus near the edge connector and two or more along the ends of the buses that run between the ICs. These should be good-quality ceramic disk capacitors at .01 uF to .1 uF capacity and 10 V dc or more voltage rating.

Fig. 3 shows the pin-out connections for connecting the PET to the expansion RAM. The connector to mate with the wire-wrap board is a 22-pin, double-readout (two rows), .156 inch spacing . . . a stock item at most parts stores.

Modifications

If memory address lines A10 and A11 were buffered on each board there would be no reason why identical boards could not be made and added to fill PET's 32K RAM capability.

Keep in mind that each 8K board with low-power versions of 2114s and interface ICs will draw about 1.1 A.

Conclusion

To the best of my knowledge the PET power supply cannot handle the additional load of the expansion board current requirements; an external power supply will be needed.

Still, the entire package can be put in a relatively small housing and sit next to the expansion port of your PET. Because of the way the PET checks to see how much memory it has to work with when it is first turned on, power must be applied to the external RAM at the same time or before the PET is turned on. After initialization the PET should read:

```
***COMMODORE BASIC***
15359 BYTES FREE
```

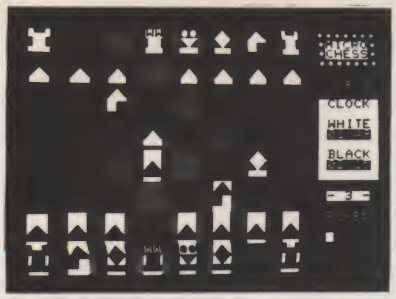
Don't forget that your PET uses 1K of RAM to store variables for the operating system.

The memory-test program will check every bit location in each RAM of the expansion board. It will display on the CRT the binary weight of the bit position being checked. If a problem is found, the program will print the location of the questionable RAM. It is in BASIC and takes about nine minutes to run. As an exercise, write one in machine language and note the run-time difference.■

PET Connector	Function	8K RAM Connector
A1	A0	22
A2	A1	21
A3	A2	20
A4	A3	19
A5	A4	18
A6	A5	17
A7	A6	16
A8	A7	15
A9	A8	14
A10	A9	13
A11	A10	1
A12	A11	2
A17	$\overline{SEL2}$	3
A18	$\overline{SEL3}$	4
A30	$\overline{R/W}$	N
A33	BD0	12
A34	BD1	11
A35	BD2	10
A36	BD3	9
A37	BD4	8
A38	BD5	7
A39	BD6	6
A40	BD7	5
B1 & B40	GND	A & Z

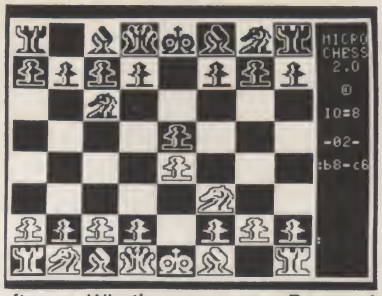
Fig. 3. Interconnecting cable. Interconnection of the PET expansion port and the 8K RAM expansion. Cable length should be one foot or less.

PET / TRS-80 / APPLE: Personal Software brings you the finest!

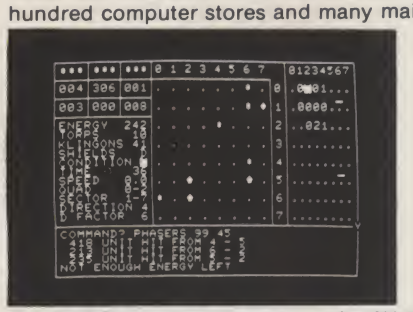


MICRO CHESS

The Industry's First Gold Cassette Over 50,000 Sold

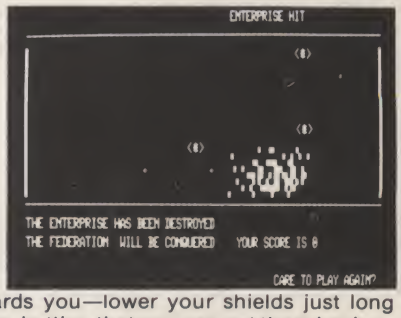


MICROCHESS is the industry's best selling computer game. And no wonder—because MICROCHESS gives you more than just a chessplaying program: A convenient, foolproof set of commands and error checks ... complete instructions in a 5½" by 8½" booklet ... a cassette that's guaranteed to load, with disk versions coming soon ... and several levels of difficulty to challenge you not just once, but time after time. It's available through well over three hundred computer stores and many mail order sources ... always originating from Personal Software. What's more, *every* Personal Software product is selected to give you these same benefits of easy availability, reliable cassettes, readable documentation, a carefully thought out user interface ... and most important, continuing challenge and enjoyment, not just once but time after time. If you haven't already, order your own gold cassette: MICROCHESS, by **Peter Jennings**, for 8K **PET**s, 16K **APPLE**s, and 4K Level I and II **TRS-80**s **$19.95**

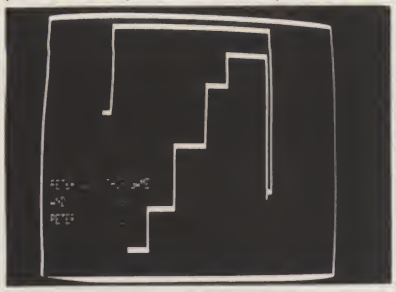


TIME TREK

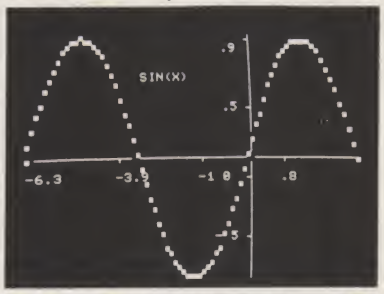
A Tour De Force In Real Time Action Strategy Games



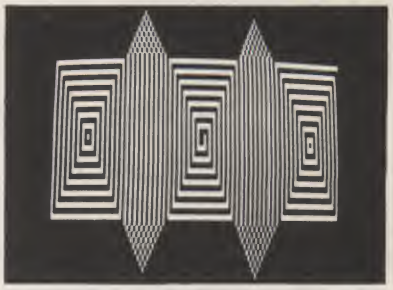
TIME TREK by **Brad Templeton** for 8K **PET**s and **Joshua Lavinsky** for 4K Level I and II **TRS-80**s adds a dramatic new dimension to the classic Star Trek type strategy game: REAL TIME ACTION! You'll need fast reflexes as well as sharp wits to win in this constantly changing game. Be prepared—the Klingons will fire at you as you move, and will move themselves at the same time, even from quadrant to quadrant—but with practice you can change course and speed, aim and fire in one smooth motion, as fast as you can press the keys. Steer under power around obstacles—evade enemy shots as they come towards you—lower your shields just long enough to fire your phasers, betting that you can get them back up in time! With nine levels of difficulty, this challenging game is easy to learn, yet takes most users months of play to master. ADD SOUND EFFECTS with a simple two-wire hookup to any audio amplifier; the TRS-80 also produces sound effects directly through the keyboard case, to accompany spectacular graphics explosions! You won't want to miss this memorable version of a favorite computer game **$14.95**



BLOCKADE by **Ken Anderson** for 4K Level I and II **TRS-80**s is a real time action game for two players, with high speed graphics in machine language. Each player uses four keys to control the direction of a moving wall. Try to force your opponent into a collision without running into a wall yourself! A strategy game at lower speeds, BLOCKADE turns into a tense game of reflexes and coordination at faster rates. Play on a flat or spherical course at any of ten different speeds. You can hear SOUND EFFECTS through a nearby AM radio—expect some razzing if you lose! **14.95**



GRAPHICS PACKAGE by **Dan Fylstra** for 8K **PET**s includes programs for the most common 'practical' graphics applications: PLOTTER graphs both functions and data to a resolution of 80 by 50 points, with automatic scaling and labeling of the axes; BARPLOT produces horizontal and vertical, segmented and labeled bar graphs; LETTER displays messages in large block letters, using any alphanumeric or special character on the PET keyboard; and DOODLER can be used to create arbitrary screen patterns and save them on cassette or in a BASIC program **$14.95**



ELECTRIC PAINTBRUSH by **Ken Anderson** for 4K Level I and II **TRS-80**s: Create dazzling real time graphics displays at speeds far beyond BASIC, by writing 'programs' consisting of simple graphics commands for a machine language interpreter. Commands let you draw lines, turn corners, change white to black, repeat previous steps, or call other programs. The ELECTRIC PAINTBRUSH manual shows you how to create a variety of fascinating artistic patterns including the one pictured. Show your friends some special effects they've never seen on a TV screen! **$14.95**

WHERE TO GET IT: *Look for the* ***Personal Software™*** *display rack at your local computer store. If you can't find the product you want, you can order direct with your VISA/Master Charge card by dialing* ***1-800-325-6400*** *toll free (24 hours, 7 days; in Missouri, dial 1-800-3426600). If you have questions, please call* ***617-783-0694****. Or you can mail your order to one of the addresses below, as of the dates shown.*

✓P39 **Personal Software™**

592 Weddell Dr.
Sunnyvale, Calif. 94086

✓ Reader Service—see page 179

Robert H. Edmonds
565 Bellevue Ave., Apt 706
Oakland CA 94610

Machine-Language Monitors for the TRS-80

First you can learn about machine-language/monitors from this discussion. Then you can use the comparative evaluation of three monitors to choose one for your TRS-80.

If you have acquired a beginning knowledge of BASIC, you probably face the question: "What next?" If you also own a TRS-80 Level I 4K, as I do, your next-step choice comes down to Level II BASIC, machine language or more memory for larger programs. Even if you already have Level II, machine language should probably be on your learning agenda.

When I bought my TRS-80 in August 1978, I anticipated going on to Level II within a month. Actually, within a few weeks, I bought T-BUG, the Radio Shack monitor for machine-language operation. I've found the experience so absorbing that I have temporarily postponed adding both Level II and 16K memory.

In this article I will recount some of my experiences learning about monitors and machine language.

Machine Language

My starting assumption is that you don't yet know machine language but are considering learning it. If you think it's "too difficult," I hope that I may encourage you to change your mind.

I also assume you know that the Z-80 microprocessor core is an 8080 with wings. Forget about the wings. Walk before you fly. Learn 8080 code first and only go on to the Z-80 embellishments when you're ready. Taken one step at a time, it all makes sense.

Since the TRS-80 has BASIC in ROM, it is ready for operation moments after you turn it on. This appeared to be the limit of the machine during its first year of sale. Simplicity of operation was a major selling point emphasized by Radio Shack in its impressive promotional campaign.

However, the article in the June 1978 *Kilobaud* ("It's Here: Machine Language for the TRS-80" by Dr. Jack W. Crenshaw, p. 90) was instrumental in my decision to buy a TRS-80. The ability to learn machine-language programming was the clincher. Radio Shack underestimates the usefulness of the TRS-80 for those who wish to use the Z-80 core of the machine by learning assembly and machine languages.

Name	Supplier	Length	Price
T-BUG	Radio Shack (RS)	.9K	$14.95
System Monitor (SysMon)	Esstoo-Deetoo Products (S2-D2)	1.0K	9.45
RSM-1	Small System Software (SSS)	1.7K	17.95

Table 1. Machine-language monitors for the TRS-80.

How Many Monitors?

Having bought T-BUG, I soon became dissatisfied. Radio Shack's documentation and guidance are not adequate for the novice. RS even admits that T-BUG is primarily for those who already know the language. To me this doesn't make sense. Certainly it didn't apply to me.

I then discovered three other monitors advertised in the September 1978 *Kilobaud*. Would one of them have been a better investment or provided better assistance to the novice? That question supplied the reason for buying three extra monitors in order to write this article.

Regrettably, Temon, from Web Associates, which was also advertised and which I also purchased, had not arrived by the end of four weeks. That exceeded the time I had available for this article. I therefore cannot include any data or comments about Temon. The three monitors I was able to evaluate are listed in Table 1.

Why a Monitor?

My understanding is that the term "monitor" is applied to the most elementary software product there is. It liberates the computer operator from the switches and lights that adorn the front panels of the first-generation home computers. Those switches and lights enable you to (1) examine the contents of any memory location, (2) change the contents to code of your own selection, (3) step readily to the next memory location (and examine or change it), (4) initiate or run a program from a chosen address once a sequence of instructions and data has been entered and (5) interrupt, halt or reset the computer during operations.

Once these basic functions have been provided (by software rather than by hardware), other functions may be added —memory dumps, breakpoints, displaying internal registers, storing programs for later reloading . . . all these and more capabilities become possible.

A monitor will usually be in ROM, whereas BASIC or any other high-level language will usually be read into working memory from cassette or other external storage. In the normal case, the added programs will utilize calls to the monitor for performance of available subroutine functions. The TRS-80 configuration reverses this procedure by having BASIC in ROM and the monitor loaded from

cassette.

For reasons not clear to me, the available monitors use fewer calls into BASIC than I would expect. Routines in BASIC, however, are used for tape-save and tape-load operations.

Primary Monitor Features

Table 2 shows all the functions and commands used by T-BUG and the S2-D2 System Monitor (SysMon). These two monitors are almost identical from a functional standpoint, although they use different letters as commands for the various functions. SysMon has a hex dump; T-BUG does not.

T-BUG is loaded into memory at 4000 to 43FF (hex), but the area up to 4100 is largely unused. It is therefore about .9K in length. SysMon resides at 4C00 to 4FFF, a full 1K byte length. S2-D2 recommends that user programs start at 4200. Memory up to that location is used by BASIC for cassette and other operations.

Documentation supplied by RS and S2-D2 differs slightly. Each provides a Mostek mini-manual that is almost impossible for the novice to use. Each supplies some information in the brief accompanying documentation that the other does not furnish. The novice must have other books or aids to use the monitor's capabilities in learning machine language.

Because T-BUG and SysMon are so closely comparable, you may not consider T-BUG worth its 58 percent higher price, unless spot delivery is vital.

Table 2, incidentally, shows only a small portion of the features of RSM-1. The surprising revelation of the Table 2 comparison is that RSM-1, the Cadillac of the array, does not provide register display or breakpoint control. I have found both of these functions a great advantage in learning how the machine-language codes actually work within the computer. I would not like to be without them.

Supplemental Monitor Features

In the course of my working with T-BUG for about six weeks, my best indication of functions I would like a monitor to possess came from needs that T-BUG did not fill. I will comment on several of them.

Clear Screen. In experimenting with memory use and discovering how easily the CRT is addressed (as memory locations from 3C00 to 3CFF), I soon came to the conclusion that I would like to be able to clear the screen with a single-letter command. So I studied T-BUG and disassembled it enough to learn how to change it. My first addition was C to clear the screen and put the monitor prompt (#) at the upper left. Incidentally, of the three monitors reviewed, only RSM-1 has a clear-screen command.

Memory Dump. Examining memory contents one address at a time seemed unnecessarily time consuming. Accordingly, my next addition was D for a memory dump. However, I wanted to be able to read the code easily, so I put only eight bytes of code on each line and skipped lines. Addresses for the start of each line are shown at the left. (T-BUG reserves the first 16 bytes of each row for monitor use, so user programs such as this memory dump must start after the first 16 locations.)

I wrote the code so that the initial memory address was replaced by that for the last of the lines. In that way, additional uses of D move the dump forward through memory as a controlled, easily readable scroll.

By comparison, each of the two monitors that provides the dump command shows 16 bytes per line for a full screen. That would be fine for printing and hard-copy storage . . . but for reading on a CRT? I like mine better. What's more, I can change it any time I want.

Search. In my learning process I wanted to find out where in BASIC or in T-BUG certain codes were used. One way to do this is to dump the full program and scan it visually. But this sort of question is ideally answered by a stupid computer that has been told *how* to do it.

The result is that I created a search subroutine (S) to locate a specified byte, print the three bytes preceding and the two bytes after and show the addresses of both the first byte and the search byte. In that way it will be difficult to make a mistake on addresses.

The additional bytes, of course, are necessary to judge whether each occurrence is a valid use of the instruction code or, alternatively, whether it may be an ASCII code or part of a memory address. Repeated uses of S display the subsequent occurrences of the code sought.

Fill Open Memory. I also wanted to zero-out unused memory space and, by this time, knew it would be easy to do. So I added a Z command and specified a starting and ending address. The S2-D2 monitor does this automatically on each loading for all memory it does not occupy. However, a voluntary command seems preferable to me.

Graphics Display. The TRS-80 contains a code for graphics shapes that is different from that used in either Level I or Level II BASIC. I discovered this by accident and spent some time creating a system for classifying the different forms.

I thought it would be nice to have a one-letter command to display this discovery, so I used K to call up a full array of alphanumeric and graphics figures. It certainly doesn't belong in a "monitor," but it's *my* monitor and that's where I have it.

If you haven't yet discovered these graphics fundamentals, be sure to check what codes 81 through BF do. (Code 80 is blank, like 20). Open memory locations between 3C10 and 3FFF and enter them, one at a time. Why hasn't Radio Shack mentioned this?

Function	Monitor Commands T-BUG	SysMon	RSM-1
Monitor Prompt	#	?	Command?
Examine Memory, one byte	M	O	E
Examine Memory (Dump)	-	H	D
Change Memory	Enter Code	Enter Code	Enter Code
Step Memory Forward	Enter	Enter	Enter, Sp Bar
Terminate Function (Return to Monitor)	X	T	Break
Execute a Program	J	E	G
Examine Registers	R	D	-
Set a Breakpoint	B	B	-
Remove a Breakpoint	F	R	-
Cont. Prog. after BP Removal	G	C	-
Save a Program on Cassette	P	S	W
Load a Program from Cassette	L	L	R,L

Table 2. Primary monitor functions and commands.

Other Monitor Features

So far I have said little about RSM-1 and have not mentioned RSM-1S. The latter is identical to RSM-1 except that it includes a 1.8K symbolic dump using Zilog mnemonics. It also costs $23.95 instead of $17.95.

Although the symbolic dump is scarcely a part of an ordinary monitor, I bought the larger package because I wanted to see how this feature worked. Having spent more than a month laboriously looking up codes and creating my own source listings for T-BUG and some other programs, I found the operation of this feature little short of phenomenal. It is well worth the $6 extra cost.

As an example of one of its

capabilities, Z-80 code uses numerous relative jumps, given in hex. Calculating the real address to which the jump refers is a pain in the posterior. RSM-1S, however, does this in a flash. Good old stupid computer!

There is only one precaution: Start the dump at an instruction code, not an address. Otherwise, the address will be interpreted as an instruction code. The same thing applies to ASCII code. It is a sophisticated dump, not a foolproof disassembler.

ASCII Dump. I'd never heard of or thought about an ASCII dump until RSM-1S arrived. Such a dump essentially converts and displays any ASCII-coded text that is incorporated in a program. Applying it to BASIC, I was surprised to see lines that read: HOW?, READY, WHAT?, SORRY, CLOAD and so on. What an aid this feature would be in interpreting any game listing or program that included text messages!

RSM-1 has a substantial number of other features: keyboard echo, move memory, test memory, verify blocks of memory, interchange blocks of memory, convert hex codes to decimal and still others. RSM-1 (and 1S) is definitely the most versatile and advanced of the products mentioned here. To cover all its capabilities would exceed a reasonable amount of space.

Keyboard Echo. This feature of RSM-1 reflects any input from the keyboard to the CRT screen. It creates a TV typewriter, but it isn't set up to record the created text. If it did, messages for games or instructional programs could easily be recorded as program segments, to be moved later to their proper positions in a finished program.

If you have ever converted text into ASCII code in order to enter it into memory, you probably realize what an aid this is. With a little work, a text recorder can be created from the Keyboard Echo subroutine.

Octal Code. All of these monitors operate in hex code. But in the earlier days of home computing, a good deal of hobbyist programming was done in octal. I think it would be nice to have a provision to accept octal code, convert it to hex and store it in memory for disassembling or execution.

Trace. One of the most difficult aspects of disassembling and studying existing programs (such as BASIC) is the frequent use of calls and jumps. It becomes extremely perplexing for the novice to follow what is really happening at the machine level. What the student needs to see is a step-by-step display of each instruction sequence in the order it is performed by the computer, not the sequence in which it is stored in memory.

None of the monitors has either the trace or octal code provisions.

Cassette Recording

Audio cassette recording for the TRS-80 is at times satisfactory and at other times highly frustrating. With Radio Shack's T-BUG, I believe I spent an hour of unsuccessful effort before I loaded it. I immediately rerecorded T-BUG several times on tapes of my own at standard volume. Since then, most of my recordings have proved reliable. But for reasons I do not understand, this has not always been true.

With both SysMon and RSM-1S, loading proved much easier, but several efforts were required. I am reluctant to buy cassette software because I suspect that it will prove difficult to load.

I think it is necessary to say bluntly that the present system of audio cassette recording with the TRS-80 is not wholly satisfactory. Its shortcomings and time wastage are not acceptable. If you buy T-BUG after reading this article, I suggest that you have the RS manager load it from the store demonstrator machine onto a cassette of your own choosing, perhaps even using your own tape recorder. Then take T-BUG home, read the literature and put the RS cassette on the shelf after trying it once to see if what I've said holds true for you. Nobody should have to spend an hour trying to get a purchased software product to work.

Present Monitor Shortcomings

Each of the monitors reviewed has problems; none is ideal. T-BUG, with minimum essentials, bombs too readily, reverts to BASIC and must be reloaded. It is too simple; it has no internal break or recovery procedures or helpful instructions to minimize the need for reloading. I haven't yet used SysMon enough to know if it is any different on this score.

RSM-1, on the other hand, is far more versatile and (I hope) far less likely to revert to BASIC. It utilizes the Break and Clear keys and has dozens of capabilities that T-BUG lacks. However, because of its length (with symbolic dump), it leaves only 80 bytes of program space. Without the symbolic dump, or by overlaying it with a user program, the RSM-1 leaves user space from 4880 to 4FFF (hex), almost 2K bytes. But it does not display registers or provide breakpoints.

Taking these points into account, I'm not sorry I have more than one monitor under present software conditions.

How About a TRS-81?

Is there any answer to these problems? Can a better system be devised?

One answer is very simple: Put the monitor in the ROM. At power-on (Restart 0) call a brief subroutine that gives a choice of entering monitor or BASIC. In a 4K ROM, perhaps 1K should be devoted to monitor and 3K to BASIC. However, since they would both use many of the same subroutines, a 1K monitor would be quite adequate and a 3K BASIC would have to give up little of what Level I now contains. By utilizing loadable subroutines, extra features could be supplied from cassette.

By redesigning the ROM, you can double the power and usefulness of the TRS-80. For machine-language applications, convenience and reliability would be multiplied.

For Level II, the same suggestion applies, except that a 2 to 4K monitor and an 8 to 10K BASIC could be used. Again, by using subroutines loadable from cassette, you can enhance the power of Level II for both BASIC and machine language.

I assume this change is both feasible and desirable. Some competitive pressure to adopt it will come from other products that have come on the market since TRS-80 appeared. Exidy's Sorcerer, for example, has a 4K ROM monitor and an 8K ROM PAC for BASIC. Combined, the Sorcerer has virtually the same BASIC capabilities as Level II, but machine-language abilities greatly exceed TRS-80's.

Additional pressure could be brought by RS customers bringing their interest to the attention of RS store managers and, by letter, to the parent office. It is also possible that an independent supplier might design a Level I or Level II monitor-BASIC ROM and offer it in competition with Radio Shack. With supplementary tape capabilities, its power and convenience would be clearly superior.

Wanted: a MenuMonitor

Until a redesigned ROM is available, any other solution for cassette or monitor problems must be found in software. I hope that those who know more than I do about software can say whether the following suggestions are feasible. If they are, I hope that one of the software houses will develop them.

I suggest that the ideal monitor for a 4K system should be multi-segmented and recorded on cassette as separate segments. The total length might well be 6K bytes or more of code. However, no section, if possible, should be more than 1.5K in length, and preferably less. The intention would be to have the operating monitor occupy no more than 2K of memory. In this way there would always be 2K of program memory available. Only those monitor features that the user expected to use for the tasks immediately ahead would be called into working memory.

The segments of the total monitor might be as follows:

1. Menu and Cassette Load Functions
2. Basic Monitor Functions
3. Hex and ASCII Memory Dumps
4. Text Entry Functions
5. Cassette Save Functions
6. Test and Verify Functions
7. Symbolic Dump

The first segment, Menu, should provide for the selection and loading of subsequent segments. It should also contain the most widely used and fundamental subroutines.

One object of this suggestion is to provide for short cassette load segments so that confirmation of successful loading is quickly obtained. One to 15 minutes to have a program loaded and working is not acceptable.

Another object is to provide a reasonable working memory. Eighty bytes, as for RSM-1S, is not sufficient. Furthermore, most of the features of a large monitor are not going to be used immediately anyhow.

Since the Menu should always be resident and callable as a Monitor function, it would be simple to overlay an unneeded capability with a new segment and a desired capability.

Given the ability of the Z-80 to provide for relative as well as absolute calls and jumps, it should be feasible to load and utilize any desired segment within a general 2K space limit. If BASIC's CLOAD and CSAVE operations are temporarily unneeded, even the memory area from 4000 to 4200H could be employed for monitor code or program use.

Final Suggestions

Create your own monitor. One lesson I have drawn from my experiences so far is that a monitor is not only an essential tool for learning machine language and controlling the computer, but it is also an excellent piece of software to use as a starting point to build in whatever features are most important to *you*.

Learn machine language. Assembly or machine language is easier to learn than most novices think. A personal computer such as the TRS-80 and a good monitor are invaluable aids in the learning process.

Although several books on 8080 and Z-80 programming exist (from Osborne and Associates, Scelbi and Sams), the right beginner's book (David Lien's *User's Manual for Level I*, for example) doesn't yet exist, as far as I know. You must work with what is available. Learn 8080 language before the Z-80 refinements.

Start now. Finally, if you're ready to start learning machine language, buy a monitor now. Don't be afraid to buy more than one if you can afford it.■

✓ Reader Service—see page 179

J. Tom Badgett
400 Albermarle St.
Bluefield WV 24701

Visit to OSI . . .

. . . in which the author reveals everything you've always wanted to know about Ohio Scientific Instruments, but were afraid to ask.

I heard an apt description of the microcomputer industry the other day: "Like walking on a waterbed—unstable and maybe a little scary." There have been dramatic changes in the field over the past three or four years, changes that have brought us to the brink of a new age in technology. This advancement hasn't occurred without problems, however. Indeed, designers, manufacturers, retailers and users have suffered the growing pains of this newest and most fascinating industry. Until now all of these groups have been little more than pioneers, blazing trails and clearing wilderness for the less intrepid followers.

Introduction

Among these pioneers must surely be listed Ohio Scientific Instruments, designers and manufacturers of microcomputers, for their story is a dichotomy of acute insight and severe tunnel vision. In 1975—when a typical microcomputer user was also an engineer, or at least a serious electronics hobbyist—OSI was pitching bareboard and single-board computer devices to the user who delighted in getting into the guts of his machine, who was thrilled by the sight and touch of the hardware and excited if he could hold BASIC in memory long enough to execute some simple programs.

OSI dealers George Harris (left) and Ed Haigh in their store in Charlottesville, Virginia. H/B Computers was one of the first to join the OSI dealer ranks.

OSI's 400 series boards apparently didn't receive too much attention beyond a hard core of dedicated OSI enthusiasts. The design basically was OK, but the company was small, and their promotional efforts didn't match those of competitors in the field.

I first heard of Ohio Scientific late in 1976. I was researching an article on new technology word processors and wrote letters to all the companies offering computer-type hardware that might be adapted for word processing. Response to my 50 or so detailed letters ranged from personal replies from high-level company officials who offered specific answers to my questions, through catalogs only, all the way to no response at all.

The simple catalog I received from OSI described what appeared to be lackluster hobbyist hardware, and since they did not provide specific responses to my questions about word processing I didn't pursue the OSI product line further. Within a few months, however, I began reading their advertisements with new interest.

Recall the microcomputer situation at that time: The most popular and most accessible machines probably were the Altair, Imsai and perhaps the SWTP. With the exception of the Southwest Tech equipment, the computers of the day were bedecked with switches and lights, required multiple accessory boards and large memory capacities and carried high prices. OSI continued to run ads with a simple sketch of a simpler box that lacked the eye-catching appeal of others in the marketplace. When I finally read the fine print it looked like the guys in Ohio had something after all.

On a limited budget but extremely interested in getting into microcomputing, I was intensely interested in the OSI model 500 board. At a time when you could spend $500 to $1000 for a pretty box with CPU and a little memory—a box that still wouldn't do anything without the addition of more memory, a cassette interface, BASIC on cassette, I/O boards, etc.—the 500's 8K BASIC in ROM, 4K RAM workspace, built-

in RS-232 and 20 mA current loop interfaces looked good indeed.

So, late in 1977 I took a gamble. I couldn't find anyone using the OSI equipment, and my letters to the factory went unanswered. Nevertheless, I bought a 500 board from H/B Computers in Charlottesville, Virginia, hooked it to a surplus power supply and an SWTP CT-64 terminal and was "on the air" with my own computer in a matter of minutes.

A Question of Support

The construction of the board seemed good and the unit worked flawlessly from the beginning. At this point there was only one problem: an almost complete lack of documentation. The manual that accompanied my 500 board was Spartan, to say the least, and sometimes even George Harris, the dealer from whom I bought the unit, couldn't shed much light on the darkness of my ignorance.

"The situation is going to change," Harris said in the winter of 1977-1978, "it has got to change and it will change." But months later OSI still was unable or unwilling to respond adequately to hardware and software questions from Harris and other OSI dealers. By spring of that year enough dealers had become so disillusioned they decided to band together in an effort to force the company to be more responsive to their needs.

About 30 dealers joined together in April in what was then —and may still be—a unique approach to the problem of dealer/company relations. These dealers agreed that OSI equipment was sound in design and construction and they wanted to continue to offer the line, but they could no longer suffer the painful lack of company response to their demands for better documentation and software to support the hardware. Each dealer agreed to put up $1000 to hire some full-time programmers to work on applications software for the growing OSI equipment line.

The power of this kind of money—coupled, apparently, with a growing realization by OSI officials that most of their dealers are "businessmen who know what they're doing," according to Harris—caused a quick improvement in relations with the company. OSI agreed that the dealer-supported programmers would be housed at the OSI factory where they could be more effective because of close contact with new equipment changes and operating system software advances. "OSI doesn't look at this as the OSI software group," Harris said, "rather it is an OSI dealer software group housed at OSI, which is the way it ought to be."

Software Development

Since then the dealer's software group has turned out a series of business programs for the OSI Challenger III system. The first effort was a package dubbed OS-DMS for Ohio Scientific Database Management System on which has been built inventory, accounts receivable, accounts payable, general ledger and payroll packages.

Wendell Banks, a Duke economics graduate and professional programmer with big-machine experience, is one of the software group programmers. "I'm trying to put on the micros what I've seen on the maxis," he told me. "Whether it is a Univac 1108, an IBM 370/168 or one of these micros, whatever the brand, the machine is a computer, and for business purposes there are certain standards that have to be met or the businessman is not going to buy."

OSI and the dealers are striving for better cooperation in software development, too. They're trying to write their software in logical blocks with common line numbers, for one thing. That way, if an individual dealer or customer needs to modify a package, he knows where to find the disk controller routines, for example, or other system control commands. And dealers are exchanging information about software they have developed themselves in an effort to cut down on duplication.

OSI software group programmer Wendell Banks hard at work. Banks says he has software running on the OSI equipment that's as good as what he used to put on the IBM 370; it just runs slower. "This OSI hardware will do the job," he says, "and it is easy to work with, but without the proper software it's like running a car without gas."

"There's no need for one dealer to work on a dental package, for example, and a surveyor package," Harris points out, "if I've already developed a dental package that would meet his needs. Let him work on the surveyor package for me and I'll help him with his dental software needs."

Indeed, OSI apparently is following similar reasoning in developing business software for general distribution. One reasonably priced business package ($995 for disk and documentation if the buyer is willing to put his books on the system himself) includes some impressive features: accounts receivable, accounts payable, general ledger, inventory, payroll, customer files maintenance, mailing label preparation and more. Ohio Scientific recently released a new version of their Word Processor with such features as automatic hyphenation, automatic line numbering, full character or global editing, FIND and CHANGE commands, incremental spacing and other output formatting features.

Also, the company has worked hard to back up its new personal line of computers (more on them later) with cassette and mini-disk software. At the end of 1978 OSI released well over 100 programs for these machines including video games with graphics, checkbook balancing and other "personal" software and business demonstration packages.

Growing Pains

So on the surface it appears OSI has met the micro software problem head on. Now the bad news. As with any new field—especially one with the growing pains experienced with microcomputing—this one has its share of problems, and OSI is suffering at least its due percentage of the total. I asked two professional programmers (guys with IBM and DEC experience) to look over the OS-DMS package. They were unimpressed.

"This is definitely not a database manager," one of the fellows lamented. "I don't know what else is out there for mi-

The Challenger III. *(Photo courtesy OSI.)*

OSI's manufacturing plant. *(Photo by Wayne Green.)*

cros so I don't really know how this stacks up against other micro software, but as a true database management system goes, this is not it."

"OS-DMS is about what you would expect from a young programmer just out of school. It is not very sophisticated," says Dan Smith, Systems Director for Tek-Aids Industries, Inc., a Chicago-based OSI dealer. Tek-Aids and a few other dealers around the country prefer to depend on what software they can write themselves or contract through local professional programmers.

George Harris is, at times, elated over the progress OSI has made in hardware and software; at times he is depressed over how far they have to go. But generally Harris remains optimistic: "We're not going to turn into a Digital Equipment DECUS users group overnight, but it is going to come a heck of a lot quicker than it did for them, that's for sure," Harris says. "Where it took them ten years to do it, I think within a couple of years we're going to have that kind of software."

Other problems, probably best summed under the heading of poor communication, plague OSI dealers. The folks at OSI are a close-knit organization, especially at the top. Mike and Charity Cheiky—husband and wife—are vice-president and president, respectively. Together they own over 60 percent of the company. OSI started small with facilities in the rear of another business in Hiram, Ohio, in 1975.

Apparently a few principals pulled the company together with personal drive and dedication . . . and up by its bootstraps. Now, OSI is housed in a 5600 square foot manufacturing facility in an industrial park in Aurora, Ohio, with around 80 employees. They have hired designers, programmers, a dealer relations expert, technical writers, etc.

Still, many OSI dealers lament that the company makes important decisions on marketing, product changes and prices, advertises those changes, and the dealers hear about them only when customers start asking questions. When a company grows from a small back-room affair to a multimillion dollar outfit in only three or four years, however, these kinds of problems can be expected.

"There are still some problems, and there are going to be some problems," Harris says, "but OSI is listening; they're bending over backwards to try to help us; you can communicate with them." So things are improving.

Hardware Design

But enough of the bad news. Dealers and OSI employees who apparently are in the know say their company isn't any worse about these problems than most of the other manufacturers. In fact, some people think OSI may be far better than many others. And, many good things can be said about OSI products and the company's business plan.

The OSI hardware alone is capable of transcending some of the most severe organizational problems, making software and documentation problems a little easier to live with. Dealers like George Harris have stayed with OSI through thick and thin because of the hardware.

"I'm really impressed with the design of the hardware," Harris says. "Every board has IC slots laid out for user modification. It's not like buying a color TV set you're afraid to touch. They even give you little hints on how you can modify their products for individual needs."

Pin No.	Description
B1	WAIT. When pulled low by a system board, causes processor clock to slow down to speed of approximately 500 kHz. Used to service slow memory and I/O devices.
B2	NMI (non-maskable interrupt). When brought low, a non-blockable interrupt occurs, causing the processor to stop its operation and service this interrupt, that is, go to a specific memory location and execute an interrupt service routine.
B3	IRO (interrupt request). An interrupt that can be masked by the processor. The processor can choose to ignore this interrupt under program control. If the interrupt is not masked, it will function as NMI above.
B4	DD (data direction). When pulled low by a system board, it changes the data direction of the 8T26 buffers on the CPU board, switching the processor from outputting data to the bus to listening to the bus.
B5-B12	Bidirectional, eight-bit data bus for communication between the processor and system boards.
B13-B16	Upper data bits on some systems.
B17	Optional reset line used to clear all PIAs and similar I/O circuitry in the system.
B18	Spare.
B19-B22	Memory management address lines (the OSI system can address memory in 64K blocks up to at least 768K).
B23	+ 12 volt power connection.
B24	− 9 volt power connection.
B25-B26	+ 5 volt power connection.
B27-B28	Ground.
B29-B38	Ten low-order address lines.
B39	Ø2. Used to clock external circuits or external I/O interfaces, such as the A/D converter (see a 6502 data sheet for more details).
B40	R/W (read/write). Originates at the microprocessor and specifies read or write operations on the data bus.
B41	VMA (valid memory address). Only used in conjunction with the 6800. The 6502 always has this line high.
B42	Ø2-VMA. Master timing signal for enabling memory and I/O in the system.
B43-B48	Six high-order address lines.

The OSI 48-pin bus.

"The fact that there is no fan in the thing, the fact that each board is without a heat sink because the voltage is regulated at the bus instead of on each board impressed me," Harris continues. He also says he has no fear about taking OSI computers to dealer shows or for customer demonstrations. The 48-pin Molex connector bus is extremely rugged.

"You can throw their stuff in the trunk of a car, carry it around town, plug it in somewhere else and it works," Harris says. "And you don't have to worry about it bombing out every time you open the refrigerator or the air conditioner comes on."

Wade Stallings, a graduate engineer with considerable design experience with computers and other digital devices, started playing with the OSI model 500 board about the same time I did. He says he is continually frustrated by the lack of in-depth documentation—he has spent hours tracing circuits, drawing diagrams and studying machine-language programming. But he's still impressed: "Whoever did OSI's design work knew what he was doing," Stallings says. "He really had his act together. They've got little things in there a lot of people never think of—especially planning for the future."

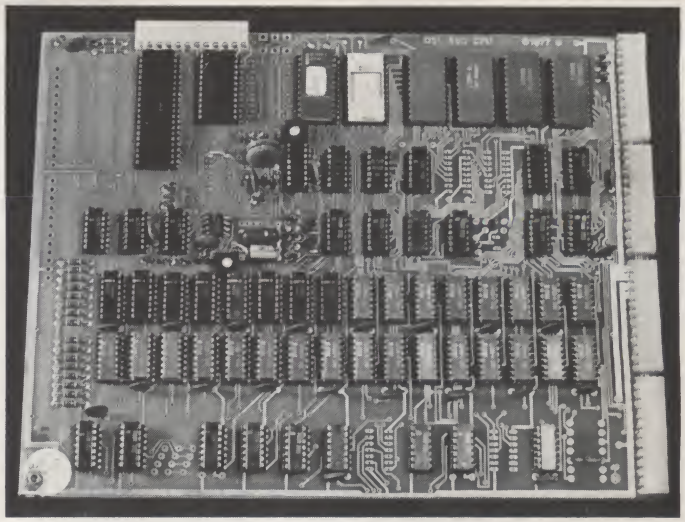
For one thing there are 20 address lines built right onto the motherboard, meaning a potential memory expansion to beyond one megabyte without redesigning. The bus structure is such that 10 MHz data operations are possible. OSI was among the first to put a full 8K BASIC in ROM right on the CPU board. Their choice of a microprocessor chip was progressive.

"I'm always looking for simplicity," Stallings says. "Too many engineers try to do things the hard way. This 6502 microprocessor is simple, and it is fast. It'll run faster at 1 MHz than a Z-80-based machine will at 4 MHz."

In 1975 the 6502 wasn't a very popular chip. Most micro manufacturers were sticking with the 8080. Most microcomputer software was being written for the 8080, and some people even thought the 6502 was destined to remain a second-rate chip, good only for hobbyists and industry. By late 1978, however, sales of the 6500 series chip had surpassed 8080 series chips' and there already was an increasing library of 6502 software.

That the 6502 lacks Z-80-type registers may even be an advantage, Stallings believes, because it can set up its own registers in a memory location in any way necessary, meaning the 6502 is more versatile. And pipelining—the ability to fetch an instruction while it is carrying out a previous one—makes it very efficient. The top-of-the-line OSI computer—the Challenger III—sports three processors available to run BASIC or machine-language programs. The user can select the 6502, 6800 or Z-80 under hardware or software control.

OSI has a full range of accessory boards designed to add to the basic system's versatility: high-speed analog-to-digital and digital-to-analog converter, a 6100 emulator to run DEC PDP-8 software, PROM programmers, multiple RS-232 ports, voice output board, graphics and graphics with color, high-speed cassette interface (1200 baud), 96 line remote parallel board and more.



This is the bulwark of the OSI computer line, the model 500 CPU. This single board computer has 8K Microsoft BASIC (in the four PROMs under OSI 500 CPU) and 4K of RAM. RS-232 and 20 mA current loop interfaces are standard. The long chip at the upper left of the board is the 6502 microprocessor. Beside it is space for a user-provided 6520 peripheral interface adaptor (PIA). Some newer versions of this board also have a disk controller built in, but lack the 4K RAM.

The Future

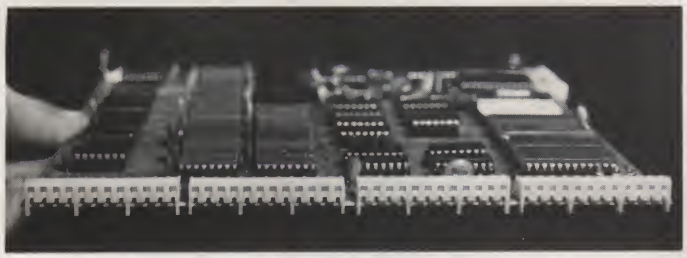
The OSI marketing philosophy is impressive, if somewhat ambitious. They want a piece of every stratum of the micro market: experimenters, hobbyists, educators, small business and big business. Their hardware line already is encroaching into all of these areas.

"We're now ready for the next big step to move us to the very edge of big-machine technology," Mike Cheiky told a recent gathering of OSI dealers at the Aurora, Ohio, factory. "We've got more horsepower than either you or your customers expect from a $4000 box," he said.

The big-machine technology Cheiky was talking about revolves around advanced software (particularly OS-DMS, which may be of questionable value unless it is greatly enhanced over presently available versions) and advanced hardware capabilities. Already available for the OSI Challenger III computer is an OKIDATA 74 megabyte hard disk, perhaps the largest on-line storage available in the micro market. With average read/write times under 50 milliseconds, the computer's statement after reset that more than 72 million bytes of user workspace is available becomes believable. To fill the gap between that large storage device and the standard 250,000 byte 8 inch floppy, OSI is developing a 20-24 megabyte hard disk for the Challenger III. Dual-sided floppies also are an option.

At the other end of the scale is the Challenger IP, a single-board machine housed in a case and with a power supply at a retail price of about $350. It has 8K BASIC, video graphics, 4K RAM (expansible to 8K on-board), can be hooked up to the standard OSI bus and can support up to two minifloppies.

There's a catch, of course. It has a limited video display of only 24 × 24 characters with a standard TV set monitor, but up to 32 × 32 characters "is possible" using a high-quality monitor with underscan. The IP is OSI's entry into the truly personal computer market. Their plans call for selling the IP in large quantities with an eye toward getting large department stores and other retail outlets



All OSI board connections are via Molex connectors. The 48 bus connectors and 12 interface connectors (up to 30 with a PIA chip installed) provide tight, trouble-free hookup to the outside world and accessory boards.

The Challenger IP. *(Photo by Wayne Green.)*

to handle the machine. Mike calls the IP "the world's lowest cost, full-featured computer."

The OSI VP feels the IP has reached its ultimate design, and there'll be no effort to redesign it ("Could you upgrade the video display?" one dealer wants to know. "What about larger memory?" asks another). "We'll not enhance its features; we'll just make it cheaper and cheaper," Cheiky responds. OSI recently launched a massive, nationwide advertising campaign in leading electronic, scientific and business magazines. The new IP computer will receive "the largest exposure of any OSI hardware." Cheiky expects to move at least 100,000 units by the end of 1979.

The Present

OSI is taking a different approach with its C2-4P computer. It is packaged very much like the IP, but the C2-4P is based on the standard OSI 48-pin Molex connector bus. Except that it doesn't have a built-in −9 volt power supply (only 5 volts *is* provided), the C2-4P is like any other OSI mainframe, just in a smaller case.

The C2-4P has been on the market since early 1977 and has proved itself a good choice for the hobbyist or for education use. Now with the new "MOD2" version, which includes graphics, mini-disk interface as well as some other goodies, OSI believes it has "the ultimate personal portable" computer. "We're going to continuously upgrade the C2-4P to keep it up with the state of the art," Cheiky says. "It is essentially obsolescence proof."

The C2-4P has a 64 character display and can support up to 48K of RAM with dual minifloppy drives. The two other mainstays of the OSI product line—the C2-8P and the Challenger II—fall somewhere between the C2-4P and the Challenger III. The 8P is identical to the C2-4P except it is housed in a full-size case with an eight-slot motherboard (the C2-4P has only four slots). The Challenger II is a full-size computer like the Challenger III, but has only the 6502 processor instead of the three processors of the Challenger III.

Ohio Scientific has one other strong suit: its software. I've already mentioned that some of their new "business" software may not be all it is cracked up to be. OSI systems software, on the other hand, is full of features and fun to use. First are the operating systems: OS-65D and OS-65U.

OS-65D came first and originally was intended as a developmental system only (thus, the "D" suffix). It has gone through several revisions, though, and is the standard operating system for all of OSI's minifloppy-based systems. OS-65D uses named files for disk storage but maintains track designation, too. That means you can save a program on disk by specifying program name and let the computer worry where it is on the disk, or you can put the program on the track of your choice.

The developmental operating system comes with a 9-digit BASIC, assembler/editor and extended monitor. One of the truly useful features of 65D is the way it handles disk data files. It supports either random or sequential files with pre-set record lengths of 128 bytes (the record length may be user changed, too). This means that to write a record on disk the user simply has to open the file and write in the information. There is no complicated head positioning or indexing; the operating system takes care of it all. When using random access files, access the information by record number. You specify record number; the computer finds it on disk and inputs it to memory where you may use it however you want.

Perhaps the best feature of the new 65D is the trend it set toward improved documentation. The manual that comes with the disk is complete and easy to use compared to most other OSI documentation. It takes the neophyte user step-by-step through the orientation procedure.

The user-oriented operating system, OS-65U, is better in some ways than 65D and is designed for far-reaching user applications. There are three versions of OS-65U. Level I is the standard version. It has named disk files, random or sequential data files (including a FIND command that will search a file for a string up to 32 characters long) and multiterminal capabilities with up to 16 terminals in a distributed processing system.

Level II adds a real-time clock and the ability to support 16 terminals operating under one master program. With Level I the multiple computers in the system can call up programs off disk and put programs on disk, but each one must have its own memory and run its program separately. Level II is a useful addition for such tasks as order entry and checking.

The most elaborate of the three, Level III, can support up to 16 totally independent tasks. Level III requires hardwired memory partitions for each terminal, with from 4K to 48K in

Challenger I	
Superboard II	4K computer on a board. 8K ROM BASIC, 4K RAM, video output with graphics, expansible to 8K on-board RAM, built-in keyboard.
C-IP	Superboard II with case and power supply
C-IP MF	C-IP with 16K RAM and minifloppy.
Challenger II	
C2-4P	Similar to IP but on standard OSI 48-pin bus and with 64 × 32 video display. 4K RAM.
C2-4P MF	A 20K C2-4P with minifloppy.
C2-8P	Identical to C2-4P except with eight expansion slots and separate keyboard.
C2-8P DF	A 32K C2-8P with dual 8 inch floppies.
C2-S2	A serial version of the C2-8P. No video board or keyboard.
Challenger III	
C3-S1	Three processors (6502, 6800, Z-80) with 32K RAM and dual 8 inch floppies, two cases.
C3-OEM	As above, with everything in one case.
C3-A	48K, dual floppies, 16-slot backplane, rack.
C3-B	As above, with 74 megabyte hard disk.
C3-C	C3-A with 24 megabyte hard disk.

Standard OSI systems.

each partition. The maximum configuration, then, would be 16 terminals, each with 48K of dedicated RAM, or a total of 768K in the system. When the system becomes this large the 74 megabyte hard disk is a practical necessity.

There are three OSI word processing packages. All feature line editing, a FIND command, formatted output, right margin justification and other standard features. WP-1 is little more than the OSI assembler/editor package, but WP-2 adds automatic hyphenation, additional printing formats, proportional spacing, named disk files and other operator conveniences. With DMS-WP-2 comes data file access or file merging. This means the user has the ability to construct a letter from previously created files, use a mailing list in a data file to type a series of "personalized" letters automatically, etc.

Perspective

Vice-President Mike Cheiky says of OSI software: "It is very competitive. Indeed, we probably could safely say it is the best in the microcomputer industry." I would say, rather, the *concept* of OSI software *may* be among the best in the industry. Its implementation across the board hasn't quite earned that distinction. OSI business software, particularly, falls short in input data error checking, operator handholding, etc. But they may be on their way. The OSI dealer network is getting stronger all the time with the number of distributors, dealers and associate dealers approaching 200.

The dealer software group is adding new members all the time, and the group is moving beyond the original software concept in mutual support. Working with factory experts, the dealer group is turning out a series of video tape presentations on OSI equipment operation, software and service techniques. A national service policy is evolving, which should give uniformity to the way dealers handle equipment problems nationwide and speed up service to the customer.

The company is publishing what Cheiky calls "the largest and most informative catalog in the industry." And they are continuously beefing up their hardware and software offerings.

"They're going to be number one in the microcomputing field; I have no doubt about it," dealer Harris says during one of his enthusiastic moments.

But in the end the true test will be how well OSI keeps up with the rapidly changing field with hardware, software, improved dealer relations and incisive marketing practices. ■

✓ Reader Service—see page 179

KIM™ BUS IS A WINNER!

AIM™, VIM™, (SYM)™, KIM™ OWNERS (and any other KIM™ bus users) buy the best 8K board available anywhere:

GRAND OPENING SPECIAL—HDE 8K RAM—$169! 3 for $465.00!

100 hour burn in—low power—commercial/industrial quality 90 day parts and labor warranty (reg. $195.00!)

KIM-1 Computer $179.00
KIM-4 Motherboards $119.00

Also—turn your KIM™ (or relative) into the best 6502 development system available at any price. Expand with HDE's full size floppy system with DOS/Editor/Assembler! If you thought the ARESCO was powerful, try this one out. Completely compatible with existing ARESCO source files. Powerful editor/DOS command structure—new 2 pass assembler. Industrial/commercial grade components with 90 day warranty. KIM bus compatible interface card—power supply for 4 drives single drive—$1995.00; dual drive $2750.00 (45 day del.)

✓P43

Add 5% for shipping. VISA/Master Charge. Free shipping on prepaid cashier's check orders.

PLAINSMAN MICRO SYSTEMS, Div. 5C Corporation
P. O. Box 1712 Auburn AL 36830 (205) 745-7735

Dealers for OSI, COMMODORE, COMPUCOLOR, ALTOS

NEW!

The first microcomputer shopping guide!

The BIG NEW 2nd edition of the Computer Data Directory is the first microcomputer shopping guide! Perfect for businessmen, educators, and personal computer users. Complete with advertisements, photographs, and useful information on thousands of companies and products. You can find the best deals easier. Includes product/manufacturer cross-reference, computer stores, consultants, software directory, publications, clubs, trade shows, entrepreneurs,. . . . .the works! There's nothing else like it. Order your copy now. Paperback (8½ x 11) only $5.98, clothbound only $11.98. Postage paid in US and Canada (foreign orders add $2.00). Allow 8-10 weeks.
Order Today!

Computer Data Publishing ✓C77
P.O. Box 598
Cleveland, Ohio 44107
(216) 221-5440

Companies...

This guide will reach thousands of qualified buyers. Do we have your product information? Call or write today for details.

Canadian 8K MEMORY KITS

M1—Fast Signetics 21L02-1 RAMs with 20 pages of Documentation—solder mask Low power Schottky—S-100 Bus—Full Buffering **$179.95**

M2—as above with DIP switch address select and Robinson Nugent IC sockets only **$199.95**

MEM1—**WAMECO** bare board as used in above kits **$39.95**

Write for info on **WAMECO** CPU and other S-100 bare boards.

ORTHON COMPUTER (ORTHON HOLDINGS LTD)

✓O8

12411 Stony Plain Rd
Edmonton, Alberta Canada T5N3N3

TRS-80

TRS-80 Add-ons

- Floppy Drives Single Shugart or Pertec system ..... $ 395
- Dual Sided Floppy System..... 695
- RAM Memory 9.75
- 32K Expansion Interface 599
- RS232 Serial I/O (simplex)..... 79
- RS232 Serial I/O (duplex)..... 95

PERIPHERAL PRODUCTS

- Floppy Kit for SA801 (8") Floppy (S-100) 599
- Add-on Floppy Drives
  SA800 or Pertec (8") unused ... 469
  SA400 or Pertec (5") unused ... 285
- Centronics 779 w/Tractors..... 1179

Ask for Free Product Line Catalog
(714) 979-9923 ✓M82

MICROCOMPUTER TECHNOLOGY INC
2098 S. Grand Ave., Santa Ana, CA 92705

★ APPLE OWNERS ★

APPLETIME, a Real Time Clock for the Apple II. Plugs directly into any slot and keeps time even when computer is off. Completely assembled and tested.
APT-1 Real Time Clock **$79.95**

PROTOBOARD, with over 1300 holes on 0.1 centers for designing your own circuits.
APB-1 Protoboard **$16.95**

VERBATIM 5¼" DISKETTES
Box of 10 ..... **$34.50**

WEST SIDE ELECTRONICS
P.O Box 636, Chatsworth, CA 91311
We pay all shipping in Continental U.S.A. Others add 10%. California residents add 6% tax

✓W29

Expand your TRS-80. Save $100.

Meet the Vista V80 Mini Disk System. The perfect way to upgrade your TRS-80* system. Inexpensively. (Our $395.00 price is about $100.00 less than the manufacturer's equivalent.) Here's how it can help you.

23% more storage capacity. Useable storage is increased from 55,000 to 65,000 bytes on drive one.

8 times faster. While electronically equal to the TRS-80 Mini-Disk system, track-to-track access is 5ms versus 40ms for the TRS-80.

Better Warranty. The V80 carries a 120 day warranty – longer than any comparable unit warranty available.

The Vista V80 Mini Disk System comes complete with Minifloppy disk drive, power supply, regulator board and case. And it's ready to run – simply take it out of the box, plug it in and you're ready to go.

Vista ✓V20

1320 E. St. Andrews Place, I
Santa Ana, CA 92705
(714) 558-8813

At Vista, we mean business

*TRS-80 ©Tandy Corp.

PET PERIPHERALS

(FOR OTHER IEEE 488 BUS COMPUTERS, TOO)

NEW — RS-232 INTERFACE: $229

The TNW-2000 Bidirectional Serial Interface allows keyboard input as well as printer output. The unit provides selectable automatic PET/ASCII character conversion, "throttled" output, baud rate adjustable from 110 to 9600 bits per second. $229 price includes power supply, cabinet, PET/IEEE cable, built-in female EIA connector, full documentation. (For software controllable RS-232 control lines, and multiple RS-232 devices, TNW offers the TNW-232D Serial Interface. Price is $369, includes power supply, cabinet, PET cable, full documentation.)

MODEM

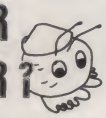
The TNW488/103 Low Speed Modem is Bell 103 compatible, provides auto originate/answer/dial capabilities. 75 to 600 bits per second. Interfaces to phone system via DAA. Price of $389 includes power supply, cabinet, cable to PET, full documentation, and software.

TNW Corporation ✓T56

Ask your dealer or contact

TNW Corporation • (714) 225-1040
5924 Quiet Slope Drive • San Diego, CA 92120

BUGS IN YOUR COMPUTER?



If not, then this is your chance to have your very own furry little (1" tall) computer bug, as shown above. Sidney comes in assorted colors with a beanie which says "Sidney the Computer Bug". He will stick to your computer with his self-sticking feet and will provide needed solice and comfort when your micro crashes.

This is the only peripheral for your micro that will not cost an arm and a leg and it's guaranteed to be compatible with your system!

Not a kit! No wiring!
No hidden surprises! No connections!
No hardware changes! No software changes!
Just a little fuzzy wuzzy that will love and watch over your computer!

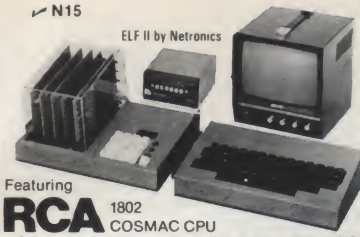
1 for $1.09, 3 for $2.50, 5 for $3.90. Postage and handling included. California promotional item. Dealer inquiries invited. Inquire about rates on larger quantities.

Write To: Sales Manager ✓A99

Arjay Enterprises
P. O. BOX 8813 - SAN MARINO, CALIFORNIA 91108

✓ Reader Service—see page 179

✓ N15



Write and run programs—the very first night—even if you've never used a computer before!

You're up and running with video graphics for just $99.95 — then use low cost add-ons to create your own personal system that rivals home computers sold for 5-times ELF II's low price!

Featuring **RCA** 1802 COSMAC CPU

Own a powerful home computer system, starting for just $99.95—a price that gets you up and running the very first night. . .with your own TV for a video display. $99.95 ELF II includes RCA 1802 8 bit microprocessor addressable to 64k bytes with DMA, interrupt, 16 registers, ALU, 256 byte RAM, full hex keyboard, two digit hex output display, stable crystal clock for timing purposes, RCA 1861 video IC to display your programs on any video monitor or TV screen *and 5 slot plug-in expansion bus (less connectors) to expand ELF II into a giant!*

ELF II Explodes Into A Giant!

Master ELF II's $99.95 capabilities, then expand with GIANT BOARD . . . KLUGE BOARD. . .4k RAM BOARDS. . .TINY BASIC. . . ASCII KEYBOARD. . . LIGHT PEN. . . ELF-BUG MONITOR. . .COLOR GRAPHICS & MUSIC SYSTEM . . . TEXT EDITOR. . . ASSEMBLER. . . DISASSEMBLER. . . VIDEO DISPLAY BOARD . . . *and*—

More Breakthroughs Coming Soon!

Soon to be introduced: ELF II special application kits that give you the hardware and software you need to use ELF II for specialized purposes such as a telephone dialer. . . industrial controller. . . home photography . . . security system. . . police alert. . . motor controller. . . station output monitor on a conveyor belt assembly line. . . and some new, super-fantastic games!

Also coming soon: PROM Programmer. . . A-D, D-A Converter. . . Controller Board. . . and more! Unlike some heavily advertised hobby computers, ELF II doesn't limit you to pre-recorded programs. With ELF II you learn computing from the ground up. . . from machine language to assembly language to BASIC . . . in quick, clear and easy steps. ELF II is a powerful computing tool, but one that you can master with the same ease you once mastered a slide rule or pocket calculator.

Master This Computer In A Flash!

Regardless of how minimal your computer background is now, you can learn to program an ELF II in almost no time at all. Our *Short Course On Microprocessor & Computer Programming*—written in non-technical language—guides you through each of the RCA COSMAC 1802's capabilities, so you'll understand *everything* ELF II can do. . . *and how to get ELF II to do it!* Don't worry if you've been stumped by computer books before. The *Short Course* represents a major advance in literary clarity in the computer field. You don't have to be a computer engineer in order to understand it. Keyed to ELF II, it's loaded with "hands on" illustrations. When you're finished with the *Short Course*, neither ELF II nor the RCA 1802 will hold any mysteries for you.

In fact, not only will you now be able to use a personal computer creatively, you'll also be able to read magazines such as BYTE. . . INTERFACE AGE. . . POPULAR ELECTRONICS and PERSONAL COMPUTING and fully *understand* the articles. And, you'll understand how to expand ELF II to give you the exact capabilities you need!

If you work with large computers, ELF II and the *Short Course* will help you understand what they're doing.

Get Started For Just $99.95, Complete!

$99.95 ELF II includes all the hardware and software you need to start writing and running programs at home, displaying video graphics on your TV screen and designing circuits using a microprocessor—the very first night—even if you've never used a computer before.

ELF II connects directly to the video input of your TV set, without any additional hardware. Or, with an $8.95 RF modulator (see coupon below), you can connect ELF II to your TV's antenna terminals instead.

ELF II has been designed to play all the video games you want, including a fascinating new target/missile gun game that was developed specifically for ELF II. But games are only the icing on the cake. The real value of ELF II is that it gives you a chance to write machine language programs—and machine language is the fundamental language of all computers. Of course, machine language is only a starting point. You can also program ELF II with assembly language and tiny BASIC. But ELF II's machine language capability gives you a chance to develop a working knowledge of computers that you can't get from running only pre-recorded tape cassettes.

ELF II Gives You The Power To Make Things Happen!

Expanded, ELF II can give you more power to make things happen in the real world than heavily advertised home computers that sell for a lot more money. Thanks to an ongoing commitment to develop the RCA 1802 for home computer use, the ELF II products—being introduced by Netronics—keep you right on the outer fringe of today's small computer technology. It's a perfect computer for engineering, business, industrial, scientific and personal applications.

Plug in the **GIANT BOARD** to record and play back programs, edit and debug programs, communicate with remote devices and make things happen in the outside world. Add **Kluge** (prototyping) **Board** and you can use ELF II to solve special problems such as operating a complex alarm system or controlling a printing press. Add **4k RAM Boards** to write longer programs, store more information and solve more sophisticated problems.

ELF II add-ons already include the **ELF II Light Pen** and the amazing **ELF-BUG Monitor**—two extremely recent breakthroughs that have not yet been duplicated by any other manufacturer.

The ELF-BUG Monitor lets you debug programs with lightening speed because the key to debugging is to know what's inside the registers of the microprocessor. And, with the ELF-BUG Monitor, instead of single stepping through your programs, you can now display the entire contents of the registers on your TV screen. You find out immediately what's going on and can make any necessary changes.

The incredible ELF II Light Pen lets you write or draw anything you want on a TV screen with just a wave of the "magic wand." Netronics has also introduced the ELF II Color Graphics & Music System—more breakthroughs that ELF II owners were the first to enjoy!

ELF II Tiny BASIC

Ultimately, ELF II understands only machine language—the fundamental coding required by all computers. But, to simplify your relationship with ELF II, we've introduced an **ELF II Tiny BASIC** that makes communicating with ELF II a breeze.

Tiny BASIC saves you the time of having to code your individual instructions in machine language for ELF II. Instead, you simply type instructions on a keyboard —PRINT, RUN, LOAD, ETC. Your Tiny BASIC program automatically translates them into machine language for ELF II. Then it translates ELF II's output back into simple words and symbols for you.

Now Available! Text Editor, Assembler, Disassembler And A New Video Display Board!

The Text Editor gives you word processing ability and the ability to edit programs or text while it is displayed on your video monitor. Lines and characters may be quickly inserted, deleted or changed. Add a printer and ELF II can type letters for you—error free—plus print names and addresses from your mailing list!

ELF II's **Assembler** translates assembly language programs into hexidecimal machine code for ELF II use. The Assembler features mnemonic abbreviations rather than numerics so that the instructions on your programs are easier to read—this is a big help in catching errors.

ELF II's **Disassembler** takes machine code programs and produces assembly language source listings. This helps you understand the programs you are working with. . . and improve them when required.

The new **ELF II Video Display Board** lets you generate a sharp, professional 32 or 64 character by 16 line upper and lower case display on your TV screen or video monitor—dramatically improving your unexpanded $99.95 ELF II. When you get into longer programs, the Video Display Board is a real blessing!

Ask Not What Your Computer Can Do. . . But WHAT CAN IT DO FOR YOU?

Don't be trapped into buying an expensive dinosaur, simply because you can afford it. ELF II is more advanced and more fun to use than big name computers that cost a lot more money. With ELF II you learn to write and run your own programs. You're not just a keypunch operator. No matter what your interests are, ELF II is the fastest way to get into computers. ***Order from the coupon below!***

Netronics R&D Ltd., Dept KB-8
333 Litchfield Road, New Milford, CT 06776

PHONE ORDERS ACCEPTED! Call (203) 354-9375

Yes! I want my own computer! Please rush me—

☐ RCA COSMAC ELF II kit at $99.95 plus $3 postage and handling (requires 6.3 to 8 volt AC power supply)

☐ Power Supply (required). $4.95 postpaid

☐ RCA 1802 User's Manual. $5 postpaid

☐ Tom Pittman's **Short Course On Microprocessor & Computer Programming** teaches you just about everything there is to know about ELF II or any RCA 1802 computer. Written in non-technical language, it's a learning breakthrough for engineers and laymen alike. $5 postpaid

☐ Deluxe Metal Cabinet with plexiglas dust cover for ELF II. $29.95 plus $2.50 p&h

☐ I am also enclosing payment (including postage & handling) for the items checked below!

☐ **I want my ELF II wired and tested with power supply, RCA 1802 User's Manual and Short Course—all for just $149.95 plus $3 p&h.**

Total Enclosed $ _____ (Conn. res. add tax)

CHARGE IT! Exp. Date _____
☐ Visa ☐ Master Charge
(Bank # _____)

Account # _____

ALSO AVAILABLE FOR ELF II —

☐ **GIANT BOARD™** kit with cassette I/O, RS-232-C/TTY I/O, 8-bit P I/O, decoders for 14 separate I/O instructions and a system monitor/editor. **$39.95** plus $2 p&h

☐ **Kluge** (Prototype) **Board** accepts up to 36 IC's. **$17.00** plus $1 p&h

☐ **4k Static RAM kit.** Addressable to any 4k page to 64k. **$89.95** plus $3 p&h

☐ Gold plated **86-pin connectors** (one required for each plug-in board). **$5.70** ea. postpaid

☐ **Expansion Power Supply** (required when adding 4k RAM). **$34.95** plus $2 p&h

☐ **Professional ASCII Keyboard** kit with 128 ASCII upper/lower case set, 96 printable characters, onboard regulator, parity, logic selection and choice of 4 hand-shaking signals to mate with almost any computer. **$64.95** plus $2 p&h

☐ **Deluxe metal cabinet for ASCII Keyboard. $19.95** plus $2.50 p&h

☐ **Video Display Board** kit lets you generate a sharp, professional 32 or 64 character by 16 line upper and lower case display on your TV screen or video monitor—dramatically improving your unexpanded $99.95 ELF II. (Fits inside ASCII Keyboard cabinet.) **$89.95** plus $2 p&h

☐ **ELF II Tiny BASIC** on cassette tape. Commands include SAVE, LOAD, +, −, ×, ÷, (), 26 variables A-Z, LET, IF/THEN, INPUT, PRINT, GO TO, GO SUB, RETURN, END, REM, CLEAR, LIST, RUN, PLOT, PEEK, POKE. Comes fully documented and includes alphanumeric generator required to display alphanumeric characters directly on your tv screen without additional hardware. Also plays tick-tack-toe plus a drawing game that uses ELF II's hex keyboard as a joy-stick. 4k memory required. **$14.95** postpaid

☐ Tom Pittman's **Short Course on Tiny Basic** for ELF II. **$5** postpaid

☐ **ELF-BUG™ Deluxe System Monitor** on cassette tape. Allows displaying the contents of all registers on your tv at any point in your program. Also displays 24 bytes of memory with full addresses, blinking cursor and auto scrolling. A must for the serious programmer! **$14.95** postpaid

☐ **Text Editor** on cassette tape gives you the ability to insert, delete or edit lines and words from your programs while they are displayed on your video monitor. (Add printer and you can use ELF II to type error-free letters, plus insert names and addresses from your mailing list.) **$19.95** postpaid

☐ **Assembler** on cassette tape translates assembly language programs into hexidecimal machine code for ELF II use. Mnemonic abbreviations for instructions (rather than numerics) make programs easier to read and help prevent errors. **$19.95** postpaid

☐ **Disassembler** on cassette tape takes machine code programs and produces assembly language source listings to help you understand and improve your programs. **$19.95** on cassette tape.

SAVE $9.90—Text Editor, Assembler & Disassembler purchased together, only **$49.95!** (Require Video Display Board plus 4k memory.)

☐ **ELF II Light Pen**, assembled & tested. **$7.95** plus $1 p&h

☐ **ELF II Color Graphics & Music System Board** kit. **$49.95** plus $2 p&h

☐ ELF II connects directly to the video input of your tv set without additional hardware. To connect ELF II to your antenna terminals instead, order **RF Modulator. $8.95** postpaid

Coming Soon: A-D, D-A Converter, Controller Board and more!

Print Name _____

Address _____

City _____

State _____ Zip _____

DEALER INQUIRIES INVITED

HAYDEN PUTS YOU ON TARGET IN BASIC

BASIC BASIC: An Introduction to Computer Programming in Basic Language, Second Edition (Coan) ". . . an excellent introduction to the use of BASIC through remote terminals and time-sharing . . . clearly written and well-organized." *Computing Reviews.* #5106-9, paper, $8.95

THE BASIC WORKBOOK: Creative Techniques for Beginning Programmers (Schoman) An introduction to the language, using only 20 keywords. Fully worked-out examples are included, plus student problems. #5104-2, $5.95

New! SIXTY CHALLENGING PROBLEMS WITH BASIC SOLUTIONS, Second Edition (Spencer) Sixty games, puzzles, mathematical recreations, and science and business problems for reinforcing computer programming skills. #5180-8, $6.95

New! BASIC WITH STYLE: Programming Proverbs (Nagin & Ledgard) Covers structured BASIC programming. Each proverb includes discussion, explanations, and sample programs. #5115-8, $5.95

GAME PLAYING WITH BASIC (Spencer) Over 60 games and puzzles in BASIC for your personal computer, with 26 games for reader solution, to challenge your programming skills. #5109-3, $7.95. Also available in 3 **Hayden Computer Program Tapes,** $9.95 each.

HAYDEN #1 in personal computing books!

Available at your local computer store!

✓ H37

Hayden Book Company, Inc.
50 Essex Street, Rochelle Park, NJ 07662

✓ Reader Service—see page 179

With these five disks, I can turn your TRS-80 into a serious computer.

My name is Irwin Taranto, and I know what I'm talking about.

I've been making computers work ever since they had vacuum tubes in them, and I've put the first computer into more than 300 different businesses.

Over the years, I've learned a few things.

For instance, I've learned that the new microcomputers like the TRS-80 are really elegant pieces of hardware. The price is deceiving. Given the right programs, they can jump through hoops.

But finding the right programs isn't all that easy. You can flip through the pages of this magazine and find 50 ads for TRS-80 programs. Granted, a good many of them are for fun and games, but you can still find quite a few offering business programs.

They aren't like mine, though.

Four of these are the genuine Osborne & Associates systems, originally designed for the $30,000 Wang computer. I've made a few minor modifications on them, and now they work on a $4000 TRS-80. The fifth program is one I added myself.

Here's what's on each disk:

THE ON-LINE, INTERACTIVE OSBORNE PROGRAMS

Accounts Payable: an invoice-linked system that can calculate and print checks, make reports, and link fully to the general ledger.

Accounts Receivable: also invoice-linked, it can keep track of billed and unbilled invoices, open and closed items and aging. It can print a statement and link to the general ledger.

General Ledger: this handles more than 1750 transactions on 200 different accounts and keeps track of them by month, quarter, year and the previous three quarters. Available with or without Cash Journal option.

Payroll: it keeps the files, computes pay and deductions, prints forms and checks, figures taxes, overtime and piecework pay, and prints the 941-A and W-2 forms.

AND AN ON-LINE, INTERACTIVE TARANTO PROGRAM

Inventory Control: a custom-tailored program that looks after up to 20 sizes of each of 1300 items — a million items in all. It gives an immediate readout on any item inquiry, including quantity and dollar total.

These programs are marvels of efficiency. They're fully-documented, and you can buy the books locally or from me. On the Osborne programs, my contribution was simply this: I made them work on the TRS-80, and if you buy them from me, I'll make them work for you.

If you're skeptical on that point, call the number below and we'll give you the names of some of the people who've already bought all over the world. Then you can call them up and hear what they have to say.

These programs only cost $99.95 each. (The Cash Journal option on the General Ledger adds another $50.) For that you get the disk, all the instructions you need, and my telephone number. If you call, we answer all your questions and make sure everything's working smoothly. If your question's tough enough, I'll talk to you personally.

Because, as I said, I plan to turn that TRS-80 of yours into a serious computer.

Please send me the following programs at $99.95 each:

		book ☑
Accounts Payable		
Accounts Receivable		
General Ledger (add $50 for Cash Journal)		
Payroll		
Inventory Control		
Add $3 per order for handling		
6% tax (California only)		
AMOUNT ENCLOSED		

If you need the books, add $15 each.

Mastercharge ☐ Visa ☐ No._____ Expires____

☐ Please send me information on other Taranto business programs

Company Name _____

Address _____

City/State/Zip _____

✓T57 **Taranto** & ASSOCIATES

Post Office Box 6073, San Rafael CA 94903 • (415) 472-1415

✓ Reader Service—see page 179

PET and TRS-80 "LOAD and GO" SOFTWARE PRE-RECORDED BUSINESS PROGRAMS

No Programming Experience Required!

*GENERAL LEDGER	66 Accounts. For home, businesses, sole proprietorships, small corporations. $29.95 plus $1.50 S & H (8K min. user memory)
*CHECKING ACCOUNT	For personal bank accounts. $23.95 plus $1.50 S & H. (8K min. user memory)
*RENT ACCOUNTS	Records of Rental Property $29.95 plus $1.50 S & H.
*LEGAL DIARY	For attorneys (client accounts). $23.95 plus $1.50 S & H.
*TRUST ACCOUNTS	For attorneys (client accounts). $23.95 plus $1.50 S & H.

Send check, money order or charges (VISA or MASTER CHARGE, include charge number and exp. date)
Specify which computer is used

-COMPUTERS ONE-

1314 South King Street, Suite 1156
Honolulu, Hawaii 96814

✓C81

Since 1977—Over 3,000 programs in use

CATCH THE S-100 INC. BUS!

	LIST PRICE	OUR SPECIAL CASH PRICE
Imsai PCS 80/10 "8080" Kit	750.00	625.00
Shugart 800-R 8" Disk Drive	610.00	425.00
Georgia Magnetics 8" Diskettes Soft Sectored per Box of 10	45.00	30.00
Godbout 8K Static "Unkit"	149.00	118.00
SSM VB-2 Video Board Kit	159.00	125.00
Dynabyte 16K Static Memory Board 250 nanoseconds	555.00	440.00

Call for Our Prices on:
Cromemco, IMSAI, Vector Graphic, North Star, Sanyo, Hazeltine, IMC plus Most Other Major Lines.

Subject to Available Quantities • Prices Quoted Include Cash Discounts
Shipping & Insurance Extra.

Bus. . . **S-100, inc.**
Address. . . **7 White Place**
Clark, N.J. 07066
Interface. . . **201-382-1318**

EXTRA SPECIAL
Prices & Delivery

PRINTERS

HEATHKIT LINE PRINTER WH-14 (ASSM) **$825.00**
Heath quality, microprocessor-controlled line printer, 96 Char. ASCII set, upper and lower case, 5x7 dot matrix print head, speed 135 CPS with selectable line length of 80, 96 or 132 Char., 110 to 4800 baud, adjustable sprocket feed from 2½" to 9½", serial I/O RS232 and 20 Ma loop. Print quality is excellent.

CENTRONICS PRINTER #779 w/tractors & paper tray **$995.00**
TEXAS INSTRUMENTS PRINTER #810 (Basic) **$1689.00**

TERMINALS

INTERTUBE II BY INTERTEC **$777.00**

(Terminal) Z-80 controlled, 80 Char. by 24 lines, 128 upper and lower case, ASCII Char., graphic symbols, reversible video, half intensity video, special 25th display (status) line, 12" screen, operating mode: conversational, message, page, Char. insert/delete, line insert/delete, half or full duplex, keyboard with 18 key numeric pad, full cursor control, RS232 and 20/60 Ma loop, auxiliary printer port, 75-9600 baud and a lot more special features all software controlled, no little mini-dip switches to bother with.

HAZELTINE 1400 VIDEO TERMINAL **$650.00**
SOROC IQ-120 TERMINAL **$795.00**
SOROC IQ-140 TERMINAL **$1296.00**
CAT ACOUSTICAL MODEM **$185.00**

DISK DRIVES

MEMOREX 550 Disk Drive 8" Double Density **$425.00**
6' cable for two drives ..... **$ 25.00**
Connectors for power supply (2 sets) ..... **$ 4.50**
Power Supply ..... **$ 98.00**
PERTEC 5¼" disk drives for TRS-80 ..... **$349.00**
Cable ..... **$ 29.50**
TRS-80 Dos rewritten & expanded ..... **$ 65.00**
TARBELL DISK CONTROLLER BOARD (Kit) **$179.00**
TARBELL CASSETTE BOARD **$110.00**

COMPUTERS

EXIDY SORCERER w/16K **$1035.00**
w/32K **$1135.00**
LEEDEX VIDEO 100 MONITOR **$135.00**
KIM-1 COMPUTER **$169.95**
PET COMPUTER 16K **$895.00**

MEMORY BOARDS

GODBOUT MEMORY BOARDS — **ALL STATIC (KIT)**
8K - $134.00 — **16K - $285.00**
32K - $549.00 — **12K** for Heath H8 **- $225.00**
I/O Board **$184.00**
4116's 16 K Dyn. Ram, Ceramic Pak. 200NS ..... **ea. $10.00**
CROMEMCO PRODUCTS ..... **10% Off**
SOUTHWEST TECH PRODUCTS ..... **10% Off**

GADGETS & GAMES

T.I.'s SPEAK N' SPELL ..... **$ 53.50**
T.I.'s SPELLING B ..... **$ 28.50**
FIDELITY ELEC's Chess Challenger III - 10 Levels **$210.00**
Voice Chess Challenger **$298.00**
Bridge Challenger **$325.00**
MAGNAVOX HOME VIDEO COMPUTER **$169.00**
Games ..... **ea. $19.50**
MATTEL ELECTRONICS
Astrology ..... **$ 45.00**
Sub Chase ..... **$ 23.00**
Soccer ..... **$ 27.00**
Baseball ..... **$ 32.00**
Football II ..... **$ 32.00**

VISA
Checks, money orders accepted
Add $2.50 freight charges on orders under 10 lbs.
Over 10 lbs. F.O.B. Cleveland
master charge

QUASAR DATA PRODUCTS
25151 Mitchell Dr., No.Olmsted, Ohio 44070(216)779-9387

RECYCLE(D) COMPUTERS

BUY ☆ SELL ☆ SWAP

Hardware & Software

NEW PRODUCT ANNOUNCEMENTS

32 pages or more

Mailed 1st Class every 3 Weeks

1 yr. (18 issues) ☆ $3.75

ON_LINE

recycle used computers

✓02

Dave Beetle, Publisher Established 1975

24695 Santa Cruz Hwy. • Los Gatos, CA 95030

THE BEST WAY TO DETERMINE IF ON_LINE CAN BE OF VALUE TO YOU IS TO TRY A ....

FREE SAMPLE ISSUE

NORTH STAR

DISK ASSEMBLER and DISK EDITOR

Both programs read and write disk files; file size not limited by memory. Assembler will assemble up to ten source files at a time; permits modular programming with programs easily relocated by reassembling at the desired address. Editor does not use line numbers; it searches for strings. Lines may be inserted, deleted and displayed. Large disk source files allow programs to be fully commented.

ASSEMBLER/EDITOR on disk with users manual...$30

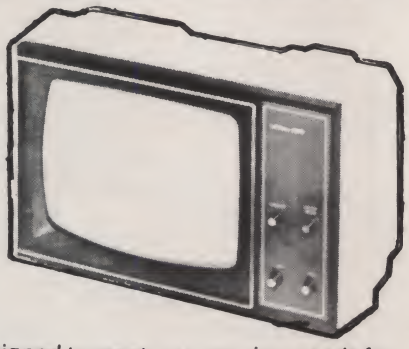
COMPUTER SYSTEMS DESIGN

906 N. Main Wichita, KS 67214

DEALERS INQUIRIES INVITED

THE PERFECT COMBINATION

$139.00



VIDEO 100 MONITOR

The Video 100 is designed to meet your monitor needs for both personal and business use. It is compatible with a wide range of computer systems, and with a bandwidth of 12 MHz it is capable of displaying up to 80 characters per line on this 12" B/W CRT. The solid state circuitry assures a stable & sharp display. The front panel controls include power, contrast, horizontal and vertical holds. Adjustments for height, vertical linearity, and width control are located on a rear panel. All the above features for only $139.00.

OE 1000 VIDEO TERMINAL

$275.00

The OE 1000 Video Terminal provides you with a low cost means to communicate with your computer. The OE 1000 will display 16 lines of 64 characters on a monitor or modified TV. The terminal will generate and display the full 96 ASCII character set (upper and lower case) plus 32 special characters (Greek letters and math symbols). The terminal will also erase to end of line, erase to end of screen, scroll, and it has full X-Y cursor movement. Interfacing to your computer requires a full duplex, serial, RS232 or 20 mA loop I/O port at the rate of 110 or 300 baud. The OE 1000 sells for $350 assembled or $275 in kit form.

Master Charge, Visa, accepted. COD Extra. Add $5 per unit, $10 both units, shipping handling insurance.

The perfect low cost combination of the OE 1000 and Video 100 are available from

OTTO ELECTRONICS

✓09

PO BOX 3066, PRINCETON, NJ. 08540 or call (609) 448-9165

✓ Reader Service—see page 179

Reader Service—see page 179

CLASSIFIEDS

Classified advertisements are intended for use by persons desiring to buy, sell or trade used computer equipment or software. No commercial ads are accepted.

Two sizes of ads are available. The $5 box allows up to 5 lines of about 35 characters per line, including spaces and punctuation. The 10 box allows up to 10 lines. Minimize use of capital letters to save space. No special layouts allowed. Payment is required in advance with ad copy. We cannot bill or accept credit.

Advertising text and payment must reach us 60 days in advance of publication (i.e., copy for March issue, mailed in February, must be here by Jan. 1). The publisher reserves the right to refuse questionable or not applicable advertisements. Mail copy with payment to: **Classifieds, Kilobaud Microcomputing, Peterborough NH 03458**. Do not include any other material with your ad as it may be delayed.

KISS is money making project via comp dating for schools, clubs. TRS-80 or any string BASIC 16K holds 400 surveys. (net $100+) List, doc., surveys, admin. instr. for $7. D. Bohlke, Coggon IA 52218.

---

*Books of computer games in BASIC. ENIGMAS-1 ($8): Gone Fishing, Concentration, Starship, Craps, Slot-Machine, Sherlock Holmes, Tank Attack. ENIGMAS-2 ($8): Number Guess, Mortar Battle, In-Between, Shell Game, Safari, Starship-2, Dice Roll, Puzzle. *Catalog and test program Frog Race, $1. Available in Standard BASIC, SWTP 8K BASIC or Radio Shack TRS-80 BASIC. Please specify. B. Erikson, PO Box 11099, Chicago IL 60611.

TRS-80 Owners! Tired of endlessly thumbing through your Level II manual? Send $1 and a self-addressed, stamped envelope and receive a complete (over 275 entries!!) Level II Manual Index. You will not believe how much time this will save you. Send $1 and SASE to Dave Rose, 3439 Harding Ave., Hapeville GA 30354.

TRS-80 Sticky Relay Problems. Instructions for the correct fix. For all TRS-80s, old and new. This one works. Send $2 to Jim Creasy, PO Box 722, Pottstown PA 19464.

TRS-80 Owners—Small business software. Ledger posting program, gives totals by month, yrtd., allows printout for verification or account statements. Inventory control pgrm., flexible for your needs. Check posting pgrm., gives totals by category, month & yrtd. Plus more. Send SASE for more details & prices. Level II 16K tape or disk. R. Lynne, PO Box 447, Carrollton TX 75006.

TRS-80 Telephone Dialer. Level II 16K program enables the computer to dial numbers from a directory in memory. Single-key redialing. Requires simple hardware installation. Cassette and complete instructions, $12.95. J. H. Nestor, 39114 Route 303, Grafton OH 44044.

PLAY $$$ONOPOLY. World famous board game for TRS-80 16K Level II. 1 to 4 players. Full graphics, $12.95 U.F. Racine, 445 S. 72, Kansas City KS 66111.

Quality TRS-80 Programs. Business, games, ham radio, Monopoly, Yahtzee, many more. Send SASE for information and complete list. Sandy Stange, Box 145, Lithonia GA 30058.

Morse code on TRS-80. Practice/send. Cassette or disk, $20. WBØQNT, Box 86, Douglass KS 67039.

For Sale: Minicomputer & Software. 64K CPU, 10M byte disk, 5 fix, 5 removable, 165 cps printer, 2 CRTs, 10 disk packs, up to 8 CRTs, 300 lpm printer, more disk & core too. Software—over 100 programs for warehouse distribution, order entry, invoicing, A/R, inventory control, sales analysis, history & commissions, systems diagnostics, many games. $30K. David Mayer, PO Box 1494, Englewood Clfs NJ 07632.

H8 Owners: Save and restore disk files to and from cassette. Program tape and instructions, $15. Double media disks, $7.50. Karl K. Sidinger, 6967 W. Rancho Dr., Glendale AZ 85303.

TRS-80 Users in Europe. We sell a great number of games, educational and scientific software and a "TRS-80 Resource Book" with programming tips, hardware/software information. Send stamped envelope for more details. Vortex 80, Postfach 401606, 8 Munchen, West Germany.

TRS-80 Level II, 16K. For the finest 16K Space Treck available (includes 4K 'Mission Briefing' plus 16K 'Combat Program'), send $14.95 to: Bill Vitulli, 4309 White Plains Rd., Bronx, NY 10466.

KIM-1 Single Pass Editor Assembler. No add-on hardware or memory req'd. 150 lines off tape or 50 resident on std. KIM. Add min. 340 & 120, respectively, for each K of addit'l memory. MOS Tech mnemonics, compatible labels/var. 18 pg documentation delivered immed. Super fast, flexible, efficient, economical. $6.50 check/MO to: T. Davis, 1521 Riverside Dr., Rainelle WV 25962.

Teletype Users: Unique solid state time delay relay. Reduces energy and maintenance costs. Info 50¢; Plans $5; with PC $10. Keith Ryan, Box 3103-K, Ottawa, Ontario, Canada K1P 6H7.

1802 Users—especially Elf II: Games! Galactica, Slot Machine, Craps I, Blackjack. All 4 for $10, cassette or memory dump. Blackjack occupies 0000-0900, others much less. Also custom programming, machine or Tiny BASIC. John Beringer, 2729 West Sahara Apt. 2, Las Vegas NV 89102.

TRS-80 Cheap Printer complete pkg. Includes source listings, Edtasm patches, and text proc., for Model 15 or other Baudot TTY. Incredibly simple interface. $25 on cass. SASE, for details. N. Gregory, 107 Fairdale, Lex. KY 40505.

TRS-80 16K Level II programs on tape. Investment portfolio evaluation, $6. Itemized income tax deduction records, $5. Both for $8. Dick Carney, 1927 S. Dewey, Bartlesville OK 74003.

TRS-80 Level I or II—Horse Race, Alphanumeric Graphics Signboard, Stock Charting; $4.50 each. Printer listing; $1.50 each. Five popular games; Cassette $5.95 Option Strategies, Level II 16K; $9.95 (listing at $3 each). C. Zalnerunas, 3034 W. Columbus Ave., Chicago IL 60652.

TRS-80 Haystack 500. Inkey pasture-style road race simulator on a twisting course. 5 skill levels from Sunday driver to Lemans and fool. Avoid odd haystacks and mudholes without crashing off the path. Good luck. Also Simple Survival—a very fast-moving race game for the real race nut. 4-16K Level II on Scotch tape. Both $11.95 to Sparky, 2318 Harvard Ave., Ft. Myers FL 33907.

Must Sell . . . Need Money A fully populated OSI Challenger III System. Includes 32K, dual 8" floppies, keyboard, video, cassette, graphics, monitor, 16 serial I/O board, 2 8-bit D/As, 1 A/D with 8 channel multiplexer, 3 parallel I/Os, 1 megabyte memory management, software switchable address for all three micros, with connecting cables . . . fully operational. Will sell for $4500. Plus 5 free disks of software with purchase, includes BASIC, Assembler, Editor, CH III Op Sys, WP-1A, OSI Level I and much, much more. Pat Reynolds (713) 674-8367.

Ohio Scientific C2-4P with connected RS-232 port and switch selectable baud rates, works perfectly. Cost $598: will sell for $498. Pat Reynolds (713) 674-8367.

SWTPC: Complete disassembled source listing of V2.0, V2.2 or V2.3 8K BASIC. Specify version $15. Mik Innova, PO Box 53, Huron OH 44839.

TRS-80 Software by Dan. Super-Calculator: simulates programmable desk calculator. 7 mem. on screen, 100 data reg. printer control, $6.95. Code practice tape generator, $5.95. Letter-writer: word-process. at a micro-price, $8.95. Call or send for list. Dan Lauck, R.R. 1, Box 87, Sherman IL 62684. (217) 629-7693.

IBM 360 CPU, $1500; disk, $500; CRT, $250; Univac complete sys, $3000. M.R. Goodman, 152 W. 42 St., Rm 412, NY NY 10036. (212) 244-4270, 787-4750 eve.

TRS-80 Ball Turret Gunner. Locate and shoot down Gnat fighters with the LW-1417 Stratablazer. This new real-time battle simulator has a continuously moving screen wth spinning star background and on-coming ships. 6 page on screen rules. 4-16K Level II. Also Vector Force (Arrows), 2 player reflex and position game. $11.95 to Sparky, 2318 Harvard Ave., Ft. Myers FL 33907. P.S. on Scotch tape.

TRS-80 Level II, 16K Hangman game. Lots of graphics. Challenging game for ages 12 & up. 16K—$9. 4K—$6. SASE for other games & info. Zumwalt, 135 E. State, Meridian ID 83642.

Bubble package your software for computer store display. As little as 35¢/package. Cassettes, paper tapes or floppy disks all fit within our standard sizes. Display racks available. $1 postage for catalog or $5 for our sample/design kit. N. Schneider, 9434 Ironwood, Des Plaines IL 60016.

For Sale: TRS-80, Level II, 16K complete system. Keyboard, cover and manual. 4 mths old. $700 COD. Call or write: David Rose, 5018-11 Hunt Club Rd., Wilmington NC 28401. (919) 392-0616 eve.

TRS-80 Level II: Convert decimal to hex & hex to dec; $5.95. G. Mattio, 472 Fordham Pky, Bay Village OH 44140.

TRS-80 Soft Key adds up to 26 user-defined phrases to your Level-II, 16K or more TRS-80. Each phrase may then be keyed by one stroke, thereby speeding your programming. No hardware mods required. Ready to run tape; $10 to Charles L. Perrin, 5001 E. Pawnee #113B, Wichita KS 67218.

TRS-80 Users: Use your T-BUG with Level II BASIC (16K) to cassette-SAVE your program with all of its data as an integrated SAVE. Substantial reduction in tape length. Details free. Full instructions, $3.50. G. Sabin, 6022 Sage Dr., Orlando FL 32807.

S-100 connectors, 20, 3 lev gold WW, some are wrapped, tab on pwr and gnd. Fits Imsai backplane. $30 for 20, $17 for half. Mark LaCasse, Tang Hall 5F, MIT, Cambridge MA 02139.(617) 494-8888.

For Sale—Alpha-Micro Computer—Includes AM-100, TEI Cabinet & Power Supply, 64K RAM, 10MB Control Data Hawk Disk Drive, AMOS Operating System, Business Software (Accounts Receivable, General Ledger, Payroll). Chester Hayes, 9-5, (717)-823-3101.

For Sale: Godbout Econoram II 8K S-100 memory board. Fully assembled and tested to 4 MHz. Asking $125. Evan Williams, 132 Upper High Crest Rd., West Milford NJ 07480.

CANADIANS: Expandor's Black Box Printer (see Jade ad in KB May 79 issue) near new. $600. L. Bradish, 1826 Trutch St., Vancouver, B.C., Canada V6K-4G3. (604) 732-5550.

Computapes—New blank cassette tapes made only for computer use. Professional quality. When you type C-Save: it'll be saved. 5, 10, 15 minutes. $2.95. J. Chaffee, 55500 Van Dyke, Washington MI 48094.

For Sale: SWTPC 6800 computer with 36K, MSI FD-8 floppy 300K disk, 2 MP-S, 2 MP-LA, 16 × 64 1200 baud stand-alone CRT terminal, AC-30 cassette I/O, all ICs socketed, complete with a super software library and disk BASIC V1.3. New $3200, best offer. Ray Jasin, R#1, Box 638, Antioch IL 60002. (312) 395-2342.

LSI-11 or Heath H11A owners: 4K memory boards by DEC, MSV11-B, new, still in factory shipped 11/03, qty. 2, $195 each. Humanic Systems Co., 18 Whipple Rd., Lex. MA 02173. (617) 862-4211.

Wanted: I wish to purchase two random beam CRT displays for use as vectored graphic displays. Displays must measure 12" or larger. Prefer working units, but can do repair or modification if necessary. Will pay top dollar for quality equipment. Send description and price to: Edward Rees, 8835 S. Oak Park Dr., Apt. #20, Oak Creek WI 53154, or (414) 764-3093.

TRS-80: Use any RS-232 keyboard printer or CRT as remote terminal. Performs all keyboard functions, places video display data on terminal. For into SASE to HS Gentry, Earlysville VA 22936.

Wanted . . . 1802 systems, hardware, software, ICs, etc. Will pay cash for RCA or Netronics cards and support systems and devices. Tom Inskip, 6504 Democracy Blvd., Bethesda MD 20034.

ASR-33 TTY w/stand, tape reader/punch. $595 & shipping, firm. 4 8K static RAM bds. S-100 fact asmb & tst. $150 ea. 1 ship. Mark Lyon, 6320 Red Prairie Rd. Sheridan OR 97378.

TRS-80 Software wanted for Education. Contact: J. Carta, Five Gunning Lane, Downingtown PA 19335.

TRS-80 disk data base/report generator. 32K. No user programming. Full functions. Random access by key or rec #. Define file parameters & report format on-line. Report features select, filter, sort, arith, summary. Multi-keys. Audit log. Blocking, hashing, buffering. Ridiculously priced at $49 so a perfect package can be enjoyed by all. Full document. If still not convinced, send $1 & 2 SASE to: Tony Pow, 96 Dothan St., Arlington MA 02174.

OSI Software C2-4P on cassette. Expense system: Maintain expense records on cassette. Recaps by month, YTD, monthly avg., percent of total. Category select for reference or taxes. Req. 4K. $9.95. Financial Analysis; home or business. Investment, loan, interest and many more. Req. 8K. $5.95. D. Newberg, 23216 N.E. 240th Ave., Battleground WA 98604.

TRS-80 s/w-payroll w/sales, $90; open item A/R, $90; Doctor calendar; radio station log; jobcost; real estate; $50 ea. SASE for info or pay in advance. D. Offutt, Rt. 1, Box 246c4, Joplin MO 64801.

Sol-20 Extended BASIC BIORYTHM program, $10. Accepts birth and current dates and plots or prints requested graph. M. Jeffery, 18 Burridge Road, Scarborough Ontario, Canada M1J 3A4.

For Sale: Professional Biorhythm Program for Apple II. Requires 16K with Applesoft in ROM or 32K with Applesoft on tape or disk. Personal biorhythm charts are potential money makers. Cost of program easily recovered with 2 or 3 charts. Printer required. Listing $9.50 ppd. Add $5 for cassette; $10 for disk. M. D. Skinas, 16266 Wayfarer Ln., Huntington Beach CA 92649.

Notice! OSI USERS. Microchess is now available, up to 3 levels of play. Autoload cassette & documentation, $15.95 (600,540,440??). Other programs in BASIC: Dive-Bomber, a fast real-time arcade type game, full of action; on tape, $5.95. Address list & editor, will keep an up-to-date file on tape. Limited only by your memory capacity. On tape, $15.95. Send $1 for catalogue of games: Joseph Endre, 3336 Avondale Court, Windsor, Ontario N9E 1X6. Phone: (519) 969-2500.

Modem: US Robotics 330 Originate/Autoanswer with DAA. Cost $324 used only 6 months, asking $275 plus ship. KSR-33 TTY, mint, stand, manuals, $325 + ship. N Capes, 586 Kent Ln., Shoreview MN 55112.

Heath H8 disk software. Data base management system, $25. Personal bills payable, $15. Program dev. utilities (variable xref, merge, sort, reformat, compare, 7 more) $25. Computer aided instruction (elementary math, spelling, general tutor program, etc.) $20. Send SASE for more info. J. D. Hill, 6400 Gila Ct., Plano TX 75023.

TRS-80 invoicing program. Level II disk. Stores invoices on disk with labor description and parts used description. Automatically prints complete invoice. Professionally written for service stations, body shops and other service organizations. $39, satisfaction guaranteed. Will customize. I also write custom programs to your specs. Write Nick Pupillo Jr., 2147 N 73rd Avenue, Elmwood Park IL 60635.

TRS-80 mach-lang prgm recovers inadvertently lost L-II or disk BASIC programs. $2 for listing you can save via T-BUG or $5 for ppd. cassette. Hal Brown, 643 W. Valley Frg. Rd., King of Prussia PA 19406.

TRS-80 users. A way of running virtually every program available. A great opportunity, easy, convenient. Choose from a large selection of programs including games and business. Available on a loan basis. Send a #10 SASE for details. L. Barreiro, 1335 S.W. 91 Avenue, Miami FL 33174.

Morse Code trainer for the 8K PET. Program has the following features: Input character—hear & see code; Receive character—input response; Receive code groups—input response; Input test—hear code; Select WPM; Displays score/errors. $10 for cassette and instructions on wiring PET for sound. Jack Fleck, 4072 Skyline Dr., Ogden UT 84403.

TRS-80 16K, Level II JBLOCK—partitions Mem—Have up to 8 BASIC prog. in mem. at once. Disassembler prog—6K—Zilog mne. Listing $2 each, cassette $3 extra. John B. Sweeney, 1 Victor Dr., Albany NY 12203.

TRS-80 and other Microsoft BASIC users: Avoid setting memory size four USR routines! Use more USR routines than your BASIC allows! $10 brings you 3 sample programs and a thorough explanation of this new programming technique. Send to: D. Fitchhorn, 2475 Calle Pino, Thousand Oaks CA 91360.

In the interest of accuracy and efficiency we ask that all classified ads please be typed, double spaced. Please do not send in ads in all caps; use upper and lowercase where appropriate. We generally will lowercase all uppercased words in the interest of space.

COMPUTER CLINIC

(from page 16)

I want to buy a microprocessor that can handle my 50,000-name mailing list (it's not that large now, but I expect it to be soon); but I want that microprocessor to be able to twice monthly run off my current subscriber's list (current 1500 and rising to 3000 by 1981) on fan-fed envelopes (not on labels) so that I can print out updated information to each subscriber (e.g., expiration information, new offers or reports and so on).

Since printout of the envelopes is my prime computer use, I prefer to find a system that can do this operation—rather than first buy a computer only to find it cannot handle the job. I would appreciate any advice from your readers!

Rohn Engh, Publisher
"The Photoletter"
Osceola WI 54020

I am currently doing genealogical research and am wondering if anyone has a program for genealogical records. I have access to a TRS-80 Level II, 16K with dual floppies.

I need pedigree, individual person and family group printouts, an index and such. If anyone has such a program, please write.

Thomas M. Cooper
PO Box 386
Temperance MI 48182

KB CALENDAR

Boston MA

Northeast Personal & Business Computer Show at Hynes Auditorium, Prudential Center, Boston MA, Friday, September 28 through Sunday, September 30, 1979. Show hours: Friday and Saturday, noon to 10 PM, Sunday noon to 6 PM. General adult admission (including seminars and lectures), $5. Northeast Exposition, PO Box 678, Brookline Village MA 02147. (617) 522-4467. Press info: Jane Badgers & Co., (617) 244-5305, 523-5563.

Chicago IL

Papers are being solicited for the November 6, 1979, Third International Conference on Computer Software and Applications—COMPSAC 79—sponsored by the IEEE Computer Society. For additional information, contact the general chairman: Dr. William Smith, Executive Director, Toll Electronic Switching and Operator Services Division, Bell Laboratories, Naperville IL 60540. (312) 690-2389.

Texas City TX

The microCOMputer Club at College of the Mainland is sponsoring a Second Annual microCOMputer Faire, Saturday, September 8, 1979. This year the club will be working with the University of Houston Computer Society toward a bigger and better show to be held at the Cullen College of Engineering at the University of Houston. For further information, contact either: Dr. John L. Hubisz, Div. Natural Science & Math, College of the Mainland, Texas City TX 77590, (713) 938-1211, ext. 244; or Dr. Nelson Marquina, Industrial Engineering Dept., University of Houston, Houston TX 77004, (713) 749-2543.

Please have calendar announcements in our hands at least three months before the month of the issue in which you want the announcement to appear. Keep announcements short and to the point, and send them to the attention of the managing editor to assure their finding their way to the editorial department. Thank you.

CORRECTIONS

Andy Latovich ("A Look Inside the TRS-80," April 1979, p. 120) found an error in his article. Fig. 3 lists the timing between the clock pulses as 2 ms. The timing should be 4 ms. A data bit, if present, should be 2 ms from the clock pulse. The pulse width is correct.

Line 340 in Fig. 14 of "It's There—But Where" (February 1979, p. 54) by S. J. Mathis, Jr., should be: 340 L(R) = L(T).

16K MEMORY UPGRADE KIT

TRS-80*/APPLE II/SORCERER

$99
REGULAR
$119.00

- Complete kit with instructions for installation
- 100% guaranteed—if any part *ever* fails we replace it free
- Available for immediate delivery

From $2679

NEC SPINWRITER PRINTER

- Letter quality, quick change print fonts
- 55 characters per second, bidirectional
- high resolution plotting/graphing, etc.
- 90-Day Warranty

$399

TRS-80* COMPATABLE DISK DRIVE

- Fully assembled and tested—ready to plug-in and run the moment you receive it
- 90-Day Warranty
- For additional information call our toll free number

DISKETTE TRS-80* BUSINESS SOFTWARE BY SBSG

(User references supplied upon request)

- **FULLY INTERACTIVE ACCOUNTING PACKAGE:** Includes General Ledger, Accounts Payable, Accounts Receivable. Report generating. Well documented and fully tested by accountants. (Based on Osborne Accounting Method). **$350**
- **INVENTORY II:** Handles up to 1000 items per disk drive. Reports include complete activity, inventory, listing, and minimum quantity search. **$99**
- **NAME & ADDRESS II:** Mailing list system. Menu driven. Includes enter, delete, update, search, sort routines, merge and print. 40 page manual. Zip Code sort is excellent for bulk mail applications. **$99**
- **ST-80 III INTELLIGENCE TERMINAL SYSTEM:** Enables a TRS-80* to act as a dial-up terminal on any standard time sharing network. Provides a TRS-80* with control key, ESC-Key, Repeat Key, Rub Out Key, Break Key, full upper and lower case support, selectable printer output and program selectable transmission rates. **$150**
- **WORD PROCESSING SYSTEM** **$150**

The CPU SHOP, Inc.

TO ORDER CALL TOLL FREE 1-800-343-6522 ✓C108

Massachusetts residents call 617/242-3350
Hours: 10 AM - 6 PM (EST) Monday - Saturday
*TRS-80 is a Tandy Corporation Trademark

39 Pleasant Street
Charlestown, Massachusetts 02129

Freight collect, F.O.B.
Charlestown

Massachusetts residents add
5% sales tax

Dealer Inquiries Invited

VISA®

master charge
THE INTERBANK CARD

✓ Reader Service—see page 179

Soroc 120	$790
Soroc 140	$1260
Hazeltine 1400	$685
Hazeltine 1410	$780
Hazeltine 1500	$999
Intertube	$764
Perkins-Elmer/Bantan.	$775

TRS-80 Level II	
16K, exp. I/O	$1199
32K, exp. I/O	$1270
Sorcer-Exidy	
16K system	$1095
32K system	$1270

24 HR. ORDER SERVICE
Ph (219) 293–4316 Mon-Sat

MID EAST MICRO

P.O. Box 621
Bristol, IN 46507

Comprint 912	$529
Heath WH-14	$749
Centronics779	$995
Dec LA36	$1345
Nec 5510	$2455
Qume Sprints/45	$2999
TI 810	$1650

Cromemco	
ZPU(kit)	$279
Z-2(kit)	$545
Z-2D(kit)	$1295
System 2	$3399
System 3	$4799
Multi-user basic	$700

HANDLING: Terminals add 3% for shipping or freight collect
TO ORDER: Send certified check or M.O. For personal or business allow 2 weeks
INDIANA RESIDENTS: add 4%

YOU'VE READ THEM ALL- NOW GET THE BEST!

The 80-US Journal

A PUBLICATION FOR TRS-80 USERS - COVERS **ALL** TRS-80 CAPABILITY!

BI-MONTHLY, SEND $16.00 CHECK OR MONEY ORDER FOR A 1 YEAR SUBSCRIPTION TO:

80 US ✓E37
PO Box 7112
TACOMA, WA. 98407

MASTER CHARGE, VISA OK - (206) 759-9642
WANT TO CHECK IT OUT FIRST? SEND $3.00 for current sample copy.

A SELECT CHOICE OF SOFTWARE IS AVAILABLE

KIM • SYM • AIM • One magazine publishes more information about 6502 based systems, products and programs than all of the others combined: **• APPLE • PET • OSI**

MICRO™

THE 6502 JOURNAL

P.O. Box 6502
Chelmsford, MA 01824

Are you tired of searching through computer magazines to find articles that relate to your 6502 system? MICRO magazine is devoted exclusively to 6502 systems. Each month, MICRO publishes application notes, hardware and software tutorials, interfacing information and program descriptions with complete source listings. MICRO is not just fun and games. It is the complete reference source for all 6502 enthusiasts.

You can order twelve issues of MICRO for $15.00, or for $18.00 outside the United States. Air mail subscriptions cost $27.00 in Central America, $33.00 in Europe and South America, and $39.00 in all other countries.

MICRO has been published regularly since October, 1977. Articles that appeared in the earlier issues of MICRO may be obtained in two bound anthologies, BEST OF MICRO Volume 1 and the companion collection ALL OF MICRO Volume 2, both available at computer stores or from the magazine.

CMC

KIM ANALOG INPUT

Analog to Digital Conversion System for the KIM Computer

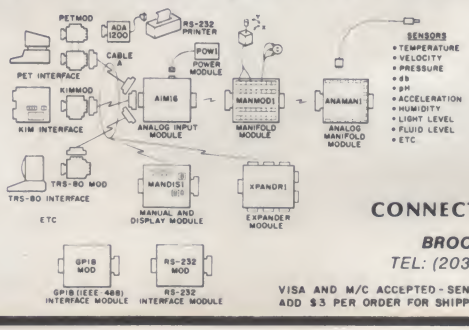
DAM SYSTEMS

Give the KIM the ability to sense, measure, and control the world around it with DAM SYSTEMS modules. Just plug the KIMSET1 into the KIM to get 16 channels of analog input. Screw terminals are provided for each channel so you can hook up joysticks, pots, or whatever appropriate sensors you have.

Each of the 16 analog inputs, in the range of 0 to 5.12 volts, is converted to a decimal number between 0 and 255 (20 millivolts per count). Conversion time is 100 microseconds.

The KIMMOD provides one user port as well as a DAM SYSTEMS port.

Software is provided.



KIMSET 1

1-AIM161	- 16 ANALOG INPUTS - 8 BITS - 100 MICROSEC
1-KIMMOD	- KIM ADAPTER - 1 USER PORT - 1 OAM SYSTEMS PORT
1-CABLE A24	- 24 INCH INTERCONNECT CABLE
1-MANMOD1	- MANIFOLD MODULE - SCREW TERMINALS FOR INPUTS, REFERENCE, GROUND
1-POW1	- POWER MODULE

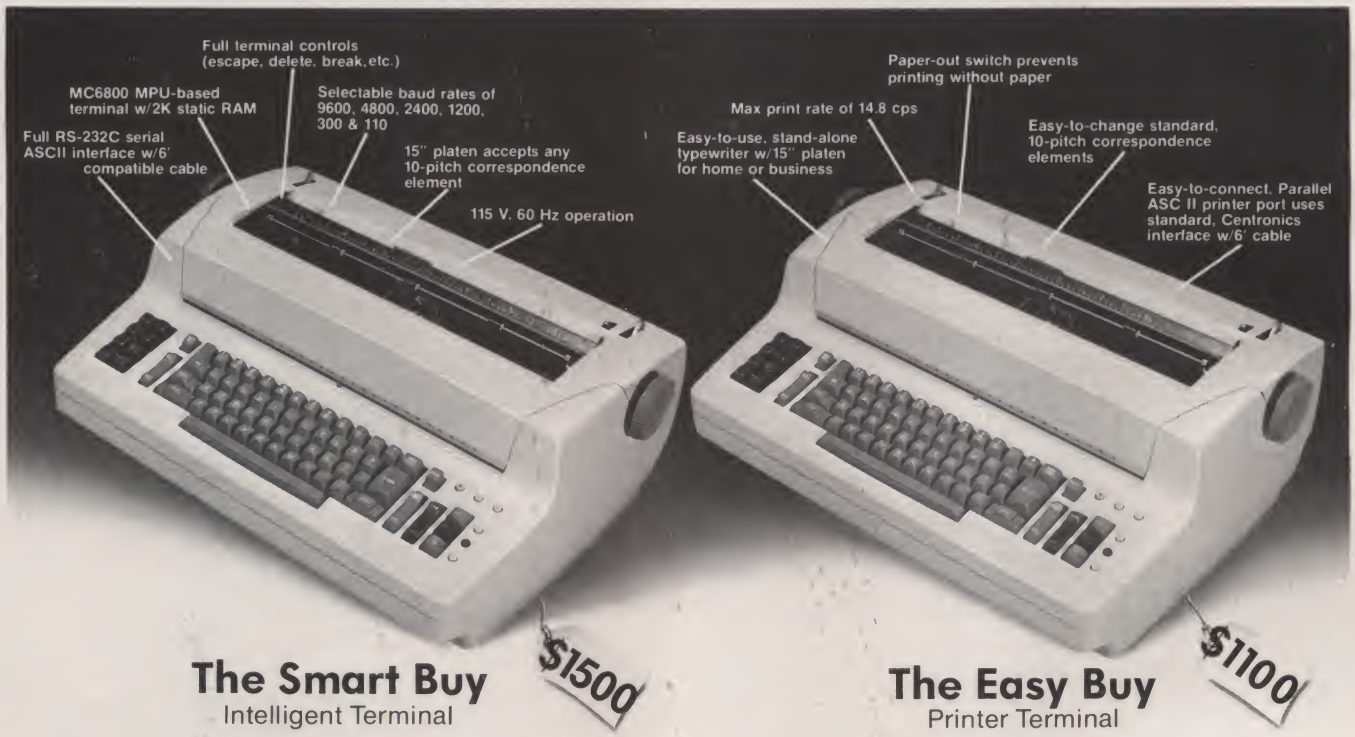
KIMSET1e for 110 VAC $ 285
KIMSET1e for 230 VAC $ 295

Order direct or contact your local computer store

CONNECTICUT microCOMPUTER, Inc.
150 POCONO ROAD
BROOKFIELD, CONNECTICUT 06804 ✓C107
TEL: (203) 775-9659 TWX: 710-456-0052

VISA AND M/C ACCEPTED - SEND ACCOUNT NUMBER, EXPIRATION DATE AND SIGN ORDER.
ADD $3 PER ORDER FOR SHIPPING & HANDLING - FOREIGN ORDERS ADD 10% FOR AIR POSTAGE

How to buy IBM Selectric Terminals.



The Smart Buy
Intelligent Terminal

The Easy Buy
Printer Terminal

Western I/O presents expertly refurbished, heavy-duty, IBM Selectrics. Two varieties—both capable of providing years of service as typewriters, but with a unique difference: they're also computer terminals. Similar, yet usable in diverse applications.

The Communications Terminal

Based on the highly-respected, IBM I/O Selectric, it incorporates standard typewriter features plus a standard computer terminal, all integrated within the Selectric housing. You just plug it into 115 Vac and connect it to your system's RS-232C connector with the cable provided and it's ready to use. Quick. Convenient. With that great IBM feel of quality. The look competitors have been trying for for years.

The Printer Terminal

IBM Selectrics are known for their well-defined, high-quality printed characters and easy-to-change elements. An ideal choice for text processing, highly-legible source listings and personal or business correspondence. And it's easy to connect to home or business computer. Just plug in 115 Vac, hook up the ASCII printer port and let 'er go.

Both terminals are maintainable by you or any qualified service using the complete documentation provided. Or you can return it to us if you so choose. Both carry a 30-day warranty on the complete unit, 90-days on the electronics.

Kits, too

Everything you need to connect your present I/O Selectric to home or business computer is provided in our easy-to-install Communications Terminal or Printer Terminal Kits. Both provide the same great features found in our standard terminals. The only difference is you provide the installation.

WESTERN I/O ✓W21

Name _____

Address _____

City _____ State _____ Zip _____

I'm interested in a great buy!

Send me: ☐ Smart Buy Terminal w/ _____ baud rate. $1500
☐ Smart Buy Kit. $650
☐ Easy Buy Terminal. $1100 ☐ Easy Buy Kit. $500
☐ Roll Paper Option (for either Terminal). $20 ☐ Data Sheet only

Send check, money order or Visa/MasterCharge number. No CODs. Personal checks require 3-4 weeks clearance. UPS, PP or common carrier shipped collect. Send inquiries to: Western I/O, 8337 E. San Miguel, Scottsdale, AZ 85253 (602) 947-0070. (Arizona residents add 5%.)

VISA MasterCharge

Clip and mail coupon today!

✓ Reader Service—see page 179

S-100 BUS VISIBILITY

For about the same price as a good logic probe, DDI's DISPLAY SENSE BOARD gives you simultaneous readout of all major S-100 BUS lines. . . .

And you get an addressable SENSE PORT plus a board that goes together quickly and easily, for only $99.95! Assembled versions are also available.
Add $2.00 shipping. Texans add 5½% sales tax. MC, VISA, COD'S welcome.

DIGITAL DYNAMICS INCORPORATED ✓D37

Digital Dynamics Incorporated
Department K, 310C Breesport
San Antonio, TX 78216
512-341-8782

Dealer Inquiries Invited

STOCK MARKET • TRADER ENTREPRENEUR

OPTION ANALYSIS SYSTEM

This system in strictly for the market speculator. Working with price, calculated volatility, and calculated average daily premium, this system picks the best buys from 75 or more options. Judgement by the analyst is required. For $35.00 you receive two programs plus example data base and instruction manual. TRS 80 LEVEL II 16K and PET

STOCK MARKET ANALYSIS SYSTEM

Technical analysis, 12 daily and 15 weekly indicators, for the stock market enthusiast. This system signaled the Oct. 78 debacle. For $25.00 you receive two programs plus data base and 27 page detailed instruction manual.
TRS 80 LEVEL I or II 16K and PET

FINANCIAL ANALYSIS SYSTEM

Includes two programs and hard copy instructions for better control of your stock and option transaction. For $20.00 you receive software with eight analysis routines. Two of these routines are stock transactions which made money and option transactions which made money. Six more program routines exist with some consideration given to taxes. Please indicate:
TRS 80 LEVEL II 16K or PET 8K

ACCOUNTING ANALYSIS SYSTEM

Includes two programs and hard copy instructions for a small cash enterprise. From your data base a Profit and Loss Statement as well as a Balance Sheet are produced. In addition simple budget comparisons are made. Please remit $20.00 and indicate:
TRS 80 LEVEL II 16K or PET 8K

LETTER PROCESSER

This program for TRS 80 owners with printers. Generates letters to different individuals with the same body. Cassette file stores names and addresses. Remit $15.00.

Distributed by: STEVEN E. SHAW P.E
P.O. Box 1707 ✓S76
Tampa, Florida 33601

See and Copy Tape Data

use TRcopy

WITH YOUR LEVEL II TRS-80*

TRcopy is a cassette tape copying system that lets you SEE what your computer is reading.

COPY ANY CASSETTE TAPE**

With the TRcopy system you can copy any TRS-80 Level II cassette tape whether it is coded in Basic or in machine language. You can also copy data created by programs and you can copy assembler listings.

YOU CAN SEE THE DATA

As the tape is being loaded, you can SEE the actual data byte-for-byte from the beginning to the end of the program. Up to 320 bytes are displayed at one time. ASCII characters are displayed on the first line and hexadecimal code is displayed on the following two lines. Data is displayed exactly as it is input including memory locations and check sums.

IDENTIFY PROGRAMS

With TRcopy you can identify programs on cassette tapes without written documentation because you can SEE the filename. If you forget to label a tape, you can use TRcopy to display the tape contents and identify the cassette.

VERIFY CASSETTE TAPES

With TRcopy you can verify both the original tape and the tape copies. You can make certain that your machine reads the original tape correctly and that it makes byte-for-byte copies. TRcopy also counts as it reads giving you the exact length of the data.

MAKE BACKUPS FOR YOUR PROGRAMS

Now you can make backup copies of your valuable programs. Many times a cassette that you make will load better than one that is mass produced. The original can then be kept as a backup in case the copy is damaged.

MAKE COPIES OF YOUR SOFTWARE

If you are in the software business you can use TRcopy to make tested copies of your programs for sales distribution. TRcopy produces machine language tapes that are more efficient than those produced by the assembler itself.

RECOVER FAULTY DATA

With TRcopy you can experiment with the volume and level controls and you can SEE what the computer is reading--even if your computer will not read the data through normal read instructions! In this way it is possible to read and copy faulty tapes by adjusting the volume control until you SEE that the data is input properly.

SIMPLE – FASCINATING – FUN

TRcopy is not only a practical utility program. It is also a fascinating graphics program that lets you SEE, for the first time, cassette data as your computer is reading it. And it's as simple as 1-2-3. Just load, verify and copy. You will now be able to use cassette tapes with confidence knowing that TRcopy is there when you need it.

The TRcopy system is a machine language program with documentation explaining tape leaders, sync bytes, check sums and other formatting conventions. With the TRcopy system, you can SEE what you are doing!

TRcopy System Including Cassette Tape and Documentation **39.95** POST PAID

Orders accompanied by money order or cashier's check mailed same day.
Orders paid by other check shipped in 14 days. No COD's. Return within 10 days for a full refund if you are not satisfied.

N.D. Orders Add 3% Sales Tax. *TRS-80 is a trademark of the Tandy Corporation. **You cannot copy the TRcopy cassette.

ORDER FROM

Data/Print

DEPT. KB, BOX 903, FARGO, N.D. 58107

CALL IN YOUR ORDER Now!

Call Toll-Free 24 Hours

If you have a Master Charge or a Visa credit card, you can call toll-free from the nearest telephone and have your TRcopy system on its way to you today.

Call 1-800-437-4144 anytime – 24 hours a day.

For calls from N.D., Hawaii or Alaska call collect 1-701-237-0216

CALL RIGHT NOW!

VISA master charge

NOW USE TRCOPY WITH YOUR PRINTER

Included at no extra cost – Now you can use the TRcopy system to output tape data to a line printer or a quick printer. The data is printed exactly as it is input from the tape including file names, memory locations and check sums. A printed copy can be especially helpful in the analysis or recovery of records contained in tape data files.

ORDER YOUR TRCOPY SYSTEM NOW!

✓D50

TOLL FREE 24 Hours SAME DAY SHIPMENT

MAILROOM PLUS©

Make Your **TRS 80** Work Like A Mini-IBM!

Mailroom Plus was developed for the National Rifle Association membership mailings. It features sorting by last name or member number in addition to zip code. The program will sort 500 names in 30-40 minutes, kill duplicates, and close up the file. **Mailroom Plus** will also search all records for category, name, state, zip (or any other search code) and print these records on labels or in tabular form. It separates large files into smaller ones by state or zip or merges small files into one large one. **Mailroom Plus** is available in Cassette (16K, Level II) for $29.95 or disk (32K) for $49.95 by first class mail. Order yours today postpaid.

THE PERIPHERAL PEOPLE
PO Box 524, Mercer Island, WA 98040

Master Charge and VISA cards welcomed

TRS - 80

SPECIAL PROMOTION SALE

SAVE 10%, 15% or more on **ALL** Computers, Peripherals, Software, and **ALL** other fine Radio Shack® products.

NO TAXES on out-of-state shipments.

FREE Surface delivery in U.S.

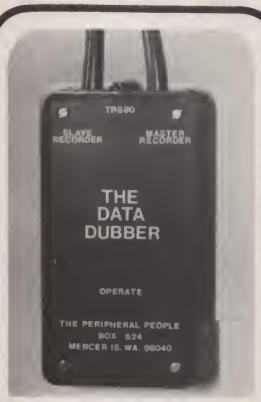
WARRANTIES will be honored by your local Radio Shack® store.

Offered exclusively by
Radio Shack®
Authorized Sales Center
1117 Conway
Mission, Texas 78572
(512) 585-2765

R34

The "DATA DUBBER"

DUPLICATES ANY PROGRAM TAPE **TRS-80**



Yes, even those in machine language! Feed your cassette into the "Data Dubber" and get out exact replicas of the TRS-80 CSAVE data pulses. Obtain perfect CLOAD's even from tapes with hum, distortion, or minor dropouts. . . and without constantly adjusting the volume. Connect a second cassette to the "Data Dubber" and make perfect reproductions, just as if the data had come from the TRS-80.

The "Dubber" works with Level I or II and costs only $39.95, postage paid. Start your own software business. Pays for itself in time saved and reduced tape cost. Order the "Data Dubber" today! If you are not completely satisfied with its performance simply return it for full refund.

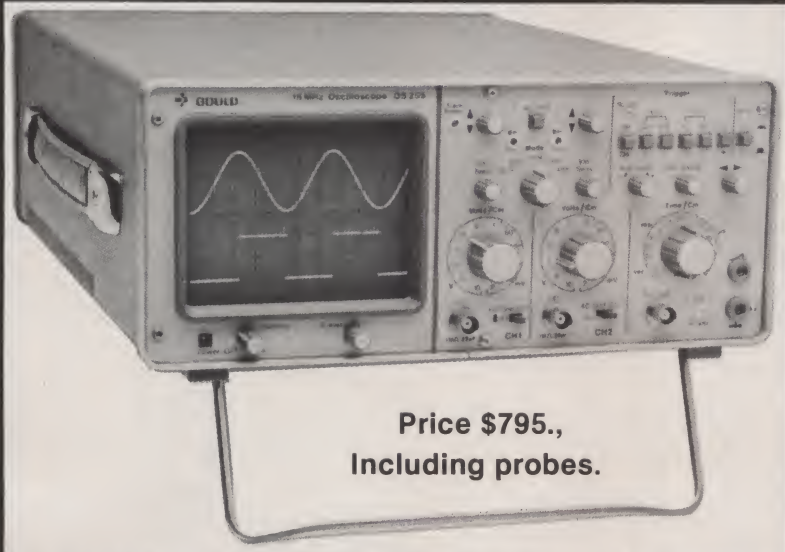
THE PERIPHERAL PEOPLE P52 PO Box 524, Mercer Island, WA 98040

'68' MICRO JOURNAL™

★ The only ALL **6800** Computer Magazine.

CHARTER SUBSCRIPTION SPECIAL
1-Year $10.50 2 Years $18.50
3 Years $26.50
OK, PLEASE ENTER MY SUBSCRIPTION
Bill my: M/C ☐ — VISA ☐
Card #_____
Expiration Date_____
For ☐ 1-Yr. ☐ 2 Yrs. ☐ 3 Yrs.
Enclosed: $_____
Name_____
Street_____
City_____
State_____ Zip_____

'68' MICRO JOURNAL™
3018 Hamill Road
HIXSON, TN 37343 S74



Price $795.,
Including probes.

Looking for reliability?
Look to the professionals
from Gould.

R. LESLIE Electronic Laboratories L24

3054 Scott Boulevard·Santa Clara Ca. 95050 (408) 727-1782

APPLE II 16K $995 !
Disk II with Controller $495
16K Mem. Exp. $89

S–100 A-D, D-A
$120 KIT
16 A-D INPUT PORTS!!
8 D-A OUTPUT PORTS!
ON BOARD KLUGE AREA FOR CUSTOM CIRCUITS!
ALL INPUTS AND OUTPUTS 0–+5 VOLTS!

4 MHz MODIFICATION KIT FOR S. D. SYSTEMS EXPANDORAM $10

J.E.S. GRAPHICS
P.O. BOX 2752
TULSA, OK 74101
[918]-742-7104 J13

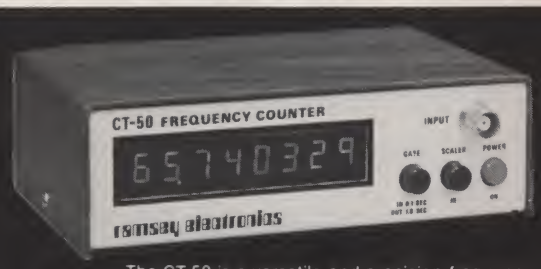
Reader Service—see page 179

FREQUENCY COUNTER KIT

Outstanding Performance

Incredible Price $89.95

CT-50



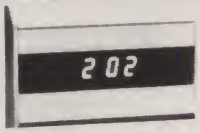
The CT-50 is a versatile and precision frequency counter which will measure frequencies to 60 mHz and up to 600 mHz with the CT-600 option. Large Scale Integration, CMOS circuitry and solid state display technology have enabled this counter to match performance found in units selling for over three times as much. Low power consumption (typically 300-400 ma) makes the CT-50 ideal for portable battery operation. Features of the CT-50 include: large 8 digit LED display, RF shielded all metal case, easy pushbutton operation, automatic decimal point, fully socketed IC chips and input protection to 50 volts to insure against accidental burnout or overload. And, the best feature of all is the easy assembly. Clear, step by step instructions guide you to a finished unit you can rely on.

Order your today!

SPECIFICATIONS:
Frequency range: 6 Hz to 65 mHz, 600 mHz with CT-600
Resolution: 10 Hz @ 0.1 sec gate, 1 Hz @ 1 sec gate
Readout: 8 digit, 0.4" high LED, direct readout in mHz
Accuracy: adjustable to 0.5 ppm
Stability: 2.0 ppm over 10° to 40° C, temperature compensated
Input: BNC, 1 megohm 20 pf direct, 50 ohm with CT-600
Overload: 50VAC maximum, all modes
Sensitivity: less than 25 mv to 65 mHz 50-150 mv to 600 mHz
Power: 110 VAC 5 Watts or 12 VDC @ 400 ma
Size: 6" x 4" x 2", high quality aluminum case, 2 lbs
ICS: 13 units, all socketed

CT-50, 60 mHz counter kit	$89.95
CT-50WT, 60 mHz counter, wired and tested	159.95
CT-600, 600 mHz scaler option, add	29.95
CB-1, Color TV calibrator-stabilizer	$14.95
DP-1, DC probe, general purpose probe	12.95
HP-1, High impedance probe, non-loadin	15.95

CAR CLOCK



The UN-KIT, only 5 solder connections

Here's a super looking, rugged and accurate auto clock which is a snap to build and install. Clock movement is completely assembled—you only solder 3 wires and 2 switches, takes about 15 minutes! Display is bright green with automatic brightness control photocell—assures you of a highly readable display, day or night. Comes in a satin finish anodized aluminum case which can be attached 5 different ways using 2 sided tape. Choice of silver, black or gold case (specify)

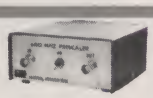
DC-3 kit, 12 hour format	$22.95
DC-3 wired and tested	$29.95
110V AC adapter	$5.95

Under dash car clock

12/24 hour clock in a beautiful plastic case features 6 jumbo RED LEDS, high accuracy (1min/mo), easy 3 wire hookup, display blanks with ignition, and super instructions. Optional dimmer automatically adjusts display to ambient light level

DC-11 clock with mtg. bracket	$27.95
DM-1 dimmer adapter	2.50

PRESCALER



Extend the range of your counter to 600 mHz. Works with any counter. Includes 2 transistor pre-amp to give super sens, typically 20 mv at 150 mHz. Specify ÷10 or ÷100 ratio.

PS-1B, 600 mHz prescaler	$59.95
PS-1BK, 600 mHz prescaler kit	49.95

OP-AMP SPECIAL

741 mini dip	12/$2.00
B1-FET mini dip, 741 type	10/$2.00

VIDEO TERMINAL

A completely self-contained, stand alone video terminal card. Requires only an ASCII keyboard and TV set to become a complete terminal unit. Two units available, common features are: single 5V supply, XTAL controlled sync and baud rates (to 9600), complete computer and keyboard control of cursor. Parity error control and display. Accepts and generates serial ASCII plus parallel keyboard input. The 3216 is 32 char. by 16 lines, 2 pages with memory dump feature. The 6416 is 64 char. by 16 lines, with scrolling, upper and lower case (optional) and has RS-232 and 20ma loop interfaces on board. Kits include sockets and complete documentation.

RE 3216, terminal card	$149.95
RE 6416, terminal card	189.95
Lower Case option, 6416 only	13.95
Power Supply Kit	14.95
Video/RF Modulator, VD-1	6.95
Assembled, tested units, add	60.00

CALENDAR ALARM CLOCK

The clock that's got it all. 6-5" LEDs, 12/24 hour, snooze, 24 hour alarm, 4 year calendar, battery backup, and lots more. The super 7001 chip is used. Size: 5x4x2 inches.
Complete kit, less case (not available)
DC-9 $34.95

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 in for 15 out, 4 W in for 30 out. Max. output of 35 W, incredible value, complete with all parts, less case and T-R relay

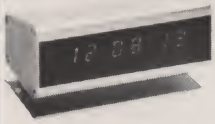
PA-1, 30 W pwr amp kit	$22.95
TR-1, RF sensed T-R relay kit	6.95

FM MINI MIKE KIT

A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available

FM-3 kit	$12.95
FM-3 wired and tested	16.95

CLOCK KITS



our Best Seller your Best Deal

Try your hand at building the finest looking clock on the market. Its satin finish anodized aluminum case looks great anywhere, while six 4" LED digits provide a highly readable display. This is a complete kit, no extras needed, and it only takes 1-2 hours to assemble. Your choice of case colors: silver, gold, bronze, black, blue (specify)

Clock kit, 12/24 hour, DC-5	$22.95
Clock with 10 min. ID timer, 12/24 hour, DC-10	27.95
Alarm clock, 12 hour only, DC-8	24.95
12V DC car clock, DC-7	27.95

For wired and tested clocks add $10.00 to kit price.

Hard to find PARTS

LINEAR ICs		**REGULATORS**	
301	$ .35	78MG	$1.25
324	1.50	723	.50
380	1.25	309K	.85
380-8	.75	7805	.85
555	.45	78L05	.25
556	.85	7905	1.25
566	1.15	7812	.85
567	1.25	7912	1.25
1458	.50	7815	.85
3900	.50	**TTL ICs**	
CMOS ICs		74$00	.35
4011	.20	7447	.65
4013	.35	7475	.50
4046	1.85	7490	.50
4049	.40	74196TI	1.35
4518	1.25	**SPECIAL ICs**	
5369	1.75	11C90	13.50
TRANSISTORS		10116	1.25
2N3904 type	10/1.00	4511	2.00
2N3906 type	10/1.00	5314	2.95
NPN 30W Pwr	3/1.00	5375AB	2.95
PNP 30W Pwr	3/1.00	7001	6.50
2N3055	.60	4059 ÷ N	9.00
UJT 2N2646 type	3/2.00	7208	17.95
FET MPF102 type	3/2.00	**LEDs**	
UHF 2N5179 type	3/2.00	Jumbo red	8/1.00
MRF-238 RF	11.95	Jumbo green	6/1.00
SOCKETS		Jumbo yellow	6/1.00
8 pin	10/2.00	Mini red	8/1.00
14 pin	10/2.00	Micro red	8/1.00
16 pin	10/2.00	BiPolar	.75
24 pin	4/2.00	**FERRITE BEADS**	
28 pin	4/2.00	With info, specs	15/1.00
40 pin	3/2.00	6 hole balun	5/1.00

Ramsey's famous MINI-KITS

FM WIRELESS MIKE KIT

Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.
FM-1 kit $2.95 FM-2 kit $4.95

COLOR ORGAN/MUSIC LIGHTS

See music come alive! 3 different lights flicker with music. One light for lows, one for the mid-range and one for the highs. Each channel individually adjustable, and drives up to 300W. Great for parties, band music, nite clubs and more.
Complete kit, ML-1 $7.95

LED BLINKY KIT

A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights, anything! Runs on 3 to 15 volts.
Complete kit, BL-1 $2.95

VIDEO MODULATOR KIT

Converts any TV to video monitor. Super stable, tunable over ch. 4-6. Runs on 5-15V, accepts std. video signal. Best unit on the market!
Complete kit, VD-1 $6.95

TONE DECODER

A complete tone decoder on a single PC board. Features 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone decoding, tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
Complete kit, TD-1 $5.95

WHISPER LIGHT KIT

An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Completely self-contained, includes mike, runs on 110VAC, controls up to 300 watts.
Complete kit, WL-1 $6.95

SUPER SLEUTH

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2 W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker.
Complete kit, BN-9 $5.95

POWER SUPPLY KIT

Complete triple regulated power supply provides variable 6 to 18 volts at 200 ma and +5V at 1 Amp. Excellent load regulation, good filtering and small size. Less transformers, requires 6.3V @ 1 A and 24 VCT.
Complete kit, PS-3LT $6.95

SIREN KIT

Produces upward and downward wail characteristic of a police siren. 5W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker.
Complete kit, SM-3 $2.95

ramsey electronics

BOX 4072, ROCHESTER, N.Y. 14610

PHONE ORDERS CALL (716) 271-6487

TERMS: Satisfaction guaranteed or money refunded. COD, add $1.50. Minimum order, $6.00. Orders under $10.00, add $.75. Add 5% for postage, insurance, handling. Overseas, add 15%. NY residents, add 7% tax.

NORTH STAR—XITAN INTERTUBE

The smartest computers at the smartest price.

DOUBLE DENSITY

HORIZON-1-16K kit,	list $1599	$1279
Assembled & tested,	list $1899	$1519
HORIZON-2-32K kit,	list $2249	$1799
Assembled & tested,	list $2549	$2039
PASCAL for NORTH STAR on Disk		$49
INTERTUBE II Terminal,	list $995	$780
Powerful NORTH STAR BASIC		FREE
XITAN Computers—Now—With QUAD DENSITY DISKS!		
Famous XITAN Software & BASIC		FREE

HORIZON & XITAN are S-100, Z-80—THE BEST

MARYELLEN Word Processing **$34** + $1.50 shipping
VERBATIM DISKS . . . 10 for **$29.50** + $1.50 shipping

Business Software, Terminals, Printers,
Computers in stock & special-ordered
Which Computers are best? BROCHURE . . . . . **FREE**

AMERICAN SQUARE COMPUTERS ✓A66

KIVETT DR ● JAMESTOWN NC 27282
(919) 883-1105

SHORT CASSETTES

List $1.00 10 for $7.50 50 for $32.50

MICROSETTE CO.
777 Palomar Ave. · Sunnyvale, CA 94086

Duplication Services

Microsette also offers professional duplication services for Commodore PET and Radio Shack TRS-80 Level I and Level II cassettes. Our service provides mastering, quality control, all material including two-piece box, affixing of your labels or supplying our blank labels and shipping. Prices start at $2.00 each in 100 quantity.

MICROSETTE CO. ✓M67
777 Palomar Ave. · Sunnyvale, CA 94086

Programmer's Guides for the PET™

T I S

WORKBOOKS FOR THE COMMODORE PET 2001

Getting Started with Your PET WB-1 $4.00
Covers the fundamentals of PET BASIC calculator and program mode, data input and output, data representation, program storage on the cassette

PET String and Array Handling WB-2 $3.95
Covers string and substring search, concatenation, replacement and manipulation

PET Graphics WB-3 $4.95
Covers use of cursor control and special graphics symbols to draw plots, histograms, and sketches

PET Cassette I/O WB-4 $4.95
Covers OPEN, CLOSE, string and numeric data files

Miscellaneous PET Features WB-5 $3.95
Covers the clock, random number generator, upper and lowercase alphabetic characters, saving memory space, etc

PET Control and Logic WB-6 $3.95
Covers IF, GOSUB, logical operations, and ON X

Add $1.50 for shipping and handling

Dealer inquiries invited

TIS
P.O. Box 921
Los Alamos, NM 87544
Money back guarantee

We also sell PET Software. Write for details. ✓T41

PET is a trademark of Commodore Business Machines

• PET 2001 • PET 2001 • PET 2001 • PET 2001 • PET 2001 • PET 2001 • PET 2001 • PET 2001 •

6800 OWNERS

At last a real world **fully addressable** SS-50 control interface. Control robots, appliances, organs, solar devices, etc. Applications limited only by your imagination. Easy to use with machine language as well as basic. Fully buffered board plugs directly onto motherboard and responds to any address defined by user. 2 fast relays latch data while 8 opto-isolators allow handshaking capacity. Kit comes with 2 relays while other 6 I/O lines are left at TTL levels. Circuit board allows addition of 6 relays available from us at nominal cost.

Kit $74.95
Assembled and tested $99.95
Additional Relays $3.98 ea

EXTENDER BOARDS

Extend both the 30 and 50 pin buses in SWTP 6800.

Both for $19.95

No COD on Canadian orders
Visa & Master Charge ● Ariz Res add 4% Sales Tax

WRITE FOR DETAILS ✓T46

TRANSITION ENTERPRISES INC.
Star Route, Box 241, Buckeye, AZ 85326

APPLE • TRS—80 • IBM • WANG • ALTAIR

MAXELL DISKS

"THE QUALITY ALTERNATIVE"

Some computerists pay less but may not get Shuggart* or IBM* approved disks or shipment may not be in hermetically sealed packages or may take many months for shipment.

MAXELL is the maker of the finest audio tape and now disks also!*

8" SINGLE DENSITY	10 FOR $50.00
8" DOUBLE DENSITY	10 FOR $65.00
5¼" MINI	10 FOR $40.00

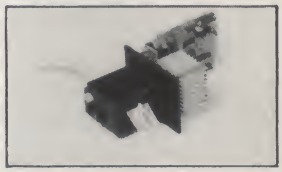
MONEY ORDERS
WE PAY FREIGHT IN U.S.A.

master charge VISA

CUSTOM ELECTRONICS ✓C132
238 EXCHANGE STREET
CHICOPEE, MASS. 01013
1—413—592-4761
HOURS: Tues. to Sat. — 9 to 5

DATA—GENERAL • CROMENCO • PET

$231 PAPER-TAPE READER HAS ONE MOVING PART

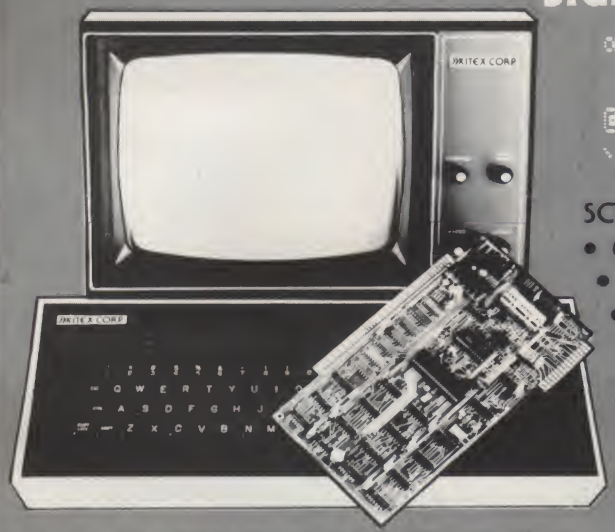


This paper-tape reader comes with TTL interface and has only one moving part. It reads any standard tape at 150 cps, asynchronous, Bi-directional, the unit stops on character and automatically detects taut tape and end of tape. The reader's user-furnished clock input is a positive-going pulse that advances tape at the input's negative-going edge and may also strobe the output data. Power requirements are + 5V at 200 mA and 24V at 600 mA. Stand alone versions with parallel or serial RS232 outputs, fanfold box and spooler are also available.

ADDMASTER CORPORATION ✓A73
416 junipero serra drive
san gabriel, ca 91776
(213) 285-1121 telex 674770
addmaster sgab

Stand Alone Video Terminal

MONITOR $139, 12" B&W




```
αßΓπΣσµτΦΘΩδ∞φε∩≡±≥≤⌠⌡÷≈°∙√ⁿ²■
 !"#$%&'() *+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~⌂
```

SCT-100 VIDEO BOARD FEATURES

- 64x16 line format with 128 displayable characters
- Serial ASCII or BAUDOT with multiple Baud rates
- **$187** Assembled or **$157** Kit (Partial Kit **$95**)
- Full cursor control with scrolling and paging
- On board power supply
- Serial interface RS232 or current loop
- Purchase SCT-100 alone or complete terminal

COMPLETE KEYBOARD TERMINAL $350
Full Kit $295 (includes SCT-100)

XITEX CORP. ✓X4
13628 Neutron P.O. Box 402110
Dallas, Texas 75240 (214) 386-3859
ORDER BY PHONE/Overseas orders & dealers welcome

10% OFF 20% OFF

YOUR OWN TRS-80 SYSTEM AT TREMENDOUS SAVINGS

❶TRS-80 Complete System
Includes: CPU/Keyboard, Power Supply, Video Monitor, Cassette Recorder, Manual, and Game Cassette.

❷Line Printer
❸Mini Disk System
❹C-10 Cassettes
❺Verbatim Diskettes

DISK DRIVES NOW IN STOCK!

ITEM		REG. PRICE	OUR PRICE
TRS-80 Complete System Level II - 4K RAM		$ 698.00	$ 628.20
TRS-80 Complete System Level II 16 K RAM		$ 988.00	$ 889.20
Expansion Interface		$ 299.00	$ 269.10
Pertec FD200 Mini Disk Drive		$ 495.00	$ 385.00
Centronics 779 Printer		$1599.00	$1175.00
Centronics 101 Printer		$1595.00	$1400.00
Anadex DP-8000 Printer		$1295.00	$ 995.00
Centronics P1 Printer		$ 534.00	$ 445.00
Trendata 1000		$1495.00	$1295.00
Memory Kit-(16K) *FREE INSTALLATION		$ 199.00	$ 98.00
Verbatim Diskettes	ea.	$ 5.95	$ 4.95
	3	$ 17.89	$ 12.00
	10	$ 59.00	$ 37.00
Maxell Diskettes	ea.	$ 10.00	$ 7.50
	3	$ 30.00	$ 21.00
	10	$ 100.00	$ 60.00
C-10 Cassettes	5	$ 4.95	$ 4.50
	25	$ 24.75	$ 18.75
C-30 Cassettes	12	$ 29.95	$ 23.95
Paper (9½" x 11" fanfold, 3500 sheets)		$ 35.00	$ 29.95

NEW & IMPORTANT SOFTWARE

Diagnostic Software

Comprehensive circuit analysis for your system **$34.95**
- RAM—tests for Random Access Memory errors
- ROM—tests for Read Only Memory errors
- CPU—tests for errors in Processor functions
- I/O—tests for Input/Output errors in peripheral equipment

The one "necessity" for any TRS-80 system—use as preventive maintenance for detecting circuit malfunctions and as a diagnostic tool for pinpointing hardware problems.

General Interest Software

Lower Case conversion - Level II - Tape – **$19.95**
- Type text on your keyboard just as you would on your typewriter
- For use with hard copy devices with a lower case option

Real Estate Package - Level II - Disk - 16K **$34.95**
- Listing & Buyer Files
- Sorts by * Price ± 5%
  * Mortgage type
  * Location
  * # of Bedrooms

Household Inventory - Level II - Tape - 16K - **$19.95**
- For Insurance claims
- Classified by Room, Purchase date, & Price
- Add, Detete, Change Routines

V19

Business software

Business Inventory - Level II - 32K - 2 Disk Drives **$49.95**
- Random Access - Double Precision - 650 Item
- Item Description, Unit cost, Selling Price, Transaction date, Catalog #, P.O. #, Qty on Hand, Reorder level, #Sold, Daily & Total Activity
- Reports Printed -
  Inventory - Activity to Date
  Re-order List - On-order List - Out of Stock List
  Dept/Sales Report - Inventory Worksheets

Comprehensive Business Data Base - Level II - 32K - 2 Disk Drives **$129.50**
Includes Inventory Above plus:
- Account Number Generation (Check digit)
- Daily Transaction & Trial Balance
- Statement of Accounts & Aging Report
- Inventory Inquiry
- Invoicing

Avail. soon for Data Base - General Ledger, P/L, Tax Reports

Payroll (115 employees) - Level II - Disk - 32K **$49.95**
- Fed-with, FICA, State, Local tax - Deducts sick pay from FICA
- Month, Qty, Year to date reports -
- Random Access - Double Precision - Can change individual fields
- Prints Checks & Stubs

VR Data corp. *MORE DATA PER DOLLAR*

777 Henderson Boulevard N-6 • Folcroft Industrial Park • Folcroft, PA 19032 • (215) 461-5300

master charge · VISA

✓ *Reader Service—see page 179*

STARFLEET ORION

A specially designed SF TACTICAL BATTLE GAME for your PET, TRS-80 or APPLE Computer.

The man called Sudden Smith watched the five blips on his screen spread out to meet the enemy. Two freighters converted into something like battlewagons, powerful but slow, and three real cruisers: the most powerful group of warships ever seen near the Promethean system — except for the Stellar Union fleet opposing them. Everyone was calling it Starfleet Orion, though it existed for only this day. It was life or death, and, after the object lesson on the planet Spring, everyone knew it.

STARFLEET ORION is a complete 2 player game system

- rule book
- battle manual
- cassette
- ship control sheets
- program listings

Includes 2 programs, 22 space ship types, and 12 playtested scenarios. Game mechanics are extremely simple, but play is exciting, challenging, and rich in detail. **Specify PET (8K) or TRS-80 (Level II, 16K) ($16.95) - or APPLE II, 16K & 32K ($18.95) (Including color and sound).**

Ask your local dealer or send your check to:

Automated Simulations ✓A71
Department B
P.O. Box 4232
Mountain View, CA. 94040
California residents please add 6% sales tax

UNCOMPROMIZED QUALITY AND PERFORMANCE IN A JOYSTICK FOR YOUR APPLE II

Available now from your local dealer
$65
or by mail from
PAIA

Whether for technical/graphics or a more realistic game of Star Wars, you' ll love this precision gimballed joystick with self-centering action and unique capacitive switch that activates with only a touch of the control shaft. Front panel accessible X and Y axis trimmers and input pushbutton are featured on the PAIA/APPLE II Joystick. Plug compatible with the APPLE II game controller. ✓P9

Distributed by: High Technology, Inc., Oklahoma City
- Dealer Inquiries Invited -

Send the PAIA/APPLE II Joystick Controller ☐ $65. 00 plus $1. 50 postage enclosed. ☐ Charge ___VISA ___MC
Card No. _____ Expiration Date: _____
name _____
address _____
city _____ state _____ zip _____

PAIA ELECTRONICS DEPT. 8 K 1020 W. WILSHIRE BLVD., OKLAHOMA CITY, OK 73116

LIGHT-PEN FOR YOUR TRS-80

PLUGS RIGHT IN! Exclusive design includes two sample programs and complete documentation so you can write your own programs in Basic. Long life from standard 9-volt battery. **A bargain at only $24.95!**

PRACTICAL APPLICATIONS™ (415) 573-8217
Post Office Box 4139, Foster City, CA 94404 ✓P60

☐ Please send me _____ TRS-80 Light Pens ($24.95 each enclosed. Calif. residents add tax).
☐ Send your catalogs.

Name _____
Address _____
City _____ State _____ Zip _____

TRS-80 is a trademark of Tandy Corp. KB879

sba's MAGIC WAND™

Turns any CP/M-based computer into a powerful word processor

Editor

- Full-screen character manipulation for any serial or DMA terminal
- Applicable for both text and program preparation
- Cut and paste, global search and replace, library files, print while editing

Printer

- Line length and page formatting, headings and footings, flexible pagination
- Easy definition of external files for form letter generation
- Simple creation of fill-in-the-blank documents

It must be magic.

Dealer inquiries invited. ✓S92

small business applications, inc.
3220 Louisiana • Suite 205 • Houston, Texas 77006

✓ Reader Service—see page 179

1. EMM 4200A, 4K Static RAMS, Ceramic A local memory boards manufacturer closed. We bought the new memory boards and took these 4200A static RAMS out. They are tested and 90-day guaranteed 100% good. Prime tested 4200A 4K RAMS $5.50 ea., 32/$160.00.

2. Motion Chip with Application Data . . . $4.50 ea.

3. High Intensity Xenan Flash Tube . . . $1.50 ea., 10/$12.00

4. Static RAMs MK4104 4K x 1 (350 nS) . . . $4.00 ea. Ltd. Qty.

5. LED's Mansanto MV5054-1 with mounting clips . . . 50/$5.00.

DELTRONIKS

5151 Buford Hwy.
Atlanta, GA 30340
(404) 458-4690

D28

The **8100** by HUH ELECTRONICS

An S-100 Bus Adapter/Motherboard for the TRS-80 plus a whole lot more!!!

- S-100 BUS INTERFACE
- 6 SLOT MOTHERBOARD
- SERIAL RS232/20ma I/O
- PARALLEL INPUT AND OUTPUT
- SPACE FOR 16K DYNAMIC RAM
- CAN USE LEFT OVER 4K CHIPS
- LOW COST— PRICES START AT $185*
- AVAILABLE IMMEDIATELY

The 8100 allows a Radio Shack TRS-80 computer to be interfaced to the popular S-100 Bus for memory expansion and extended I/O capabilities. For example, you can now easily add more memory, floppy disc systems, PROM boards, printer interfaces, multi-purpose I/O boards, AC device controllers, and a whole host of other varied peripherals.

The 8100 has its own built-in 6 slot motherboard which includes our unique card guide system which keeps the boards in their places.

The 8100 has support circuitry and sockets for eight 16K dynamic RAM chips allowing you to expand the memory of your TRS-80 by 16K without having to buy any S-100 RAM boards.

If you purchased an expansion memory kit for TRS-80 you could be left with eight 4K RAM chips and nowhere to put them! Well, they can go in the RAM sockets instead! That's right, you can use either 4K or 16K chips and address them anywhere you like.

The 8100 has a full RS232/20 ma serial interface who's features include: RS232 and 20 ma current loop interface, software programmable baud rate from DC to 56K baud, software programmable modem control lines, on board DB-25 connector and much more.

The 8100 also has an 8 bit parallel input port and an 8 bit parallel output port. Both are latched, have both positive and negative strobe inputs and outputs and have plenty of drive capability.

PRICES START AS LOW AS $185* (S-100 BUS INTERFACE ONLY)

HUH ELECTRONICS

1429 Maple St.
San Mateo, CA
94402
(415) 573-7359

H29

CALL OR WRITE FOR COMPLETE PRICING INFORMATION AND MORE DETAILS

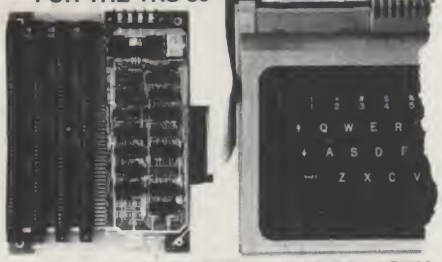
THE 8100 IS AVAILABLE FROM LEADING COMPUTER DEALERS OR FACTORY DIRECT

DEALER INQUIRIES INVITED

*Extra S-100 connectors, RAM support, I/O circuitry optional
USA DOMESTIC PRICE ONLY

HUH ELECTRONICS ANNOUNCES THE **MINI-8100**

AN S-100 BUS ADAPTER/MOTHERBOARD FOR THE TRS-80*



MINI-SIZE!

MINI-PRICE!

but **MAXI-PERFORMANCE!**

HUH Electronics' 8100 is the established leader in S-100/TRS-80 interfaces, running reliably since November 1978 and giving you the most features for your dollar. But some folks don't need all the 8100's versatility or want something more compact.

So we created the **MINI-8100.** The **MINI-8100** has the same proven reliable S-100 Bus interface circuitry as it's big brother coupled with a 4 slot shielded motherboard. It connects to the TRS-80 or to the expansion interface and opens up the vast world of S-100 Bus products to the TRS-80 owner.

For those of you who already own an S-100 mainframe or motherboard, the **MINI-8100** may be purchased without the built-in motherboard, **(MINI-8100S).** Just plug it in and go!

The **MINI-8100** has the same high quality as all HUH Electronics products—easy assembly, fully socketed, solder mask and silk screen component legend, comprehensive manual and design excellence that speaks for itself.

PRICES

MINI-8100 KIT	- includes all parts and one S-100 connector	- $115
MINI-8100 ASM	- assembled and tested, includes four S-100 connectors	- $155
MINI-8100S KIT	- S-100 sized board, plugs into mainframe	- $ 95
MINI-8100S ASM	- same as above, but assembled and tested	- $125

HUH ELECTRONICS

1429 Maple St.
San Mateo, CA
94402
(415) 573-7359

H29

ORDERING INFO: The **MINI-8100** is available from leading computer dealers or factory direct. Please include $4 for shipping and handling. CA residents include 6% sales tax. We accept VISA or Mastercharge or we can ship COD.

USA DOMESTIC PRICES ONLY.

DEALER INQUIRIES INVITED

TRS-80 is a Radio Shack product.

MAGSAM™

KEYED FILE MANAGEMENT

Put data at your fingertips...easily accessed, displayed and updated by key. Designed to meet all of your data management needs, MAGSAM™ allows you to quickly implement sophisticated keyed file structures through simple CBASIC statements.

Standard MAGSAM™ features include record retrieval with random by key, sequential by key, and generic ("wild card") search, and complete compatibility with all CBASIC file facilities. Each MAGSAM™ Package includes the MAGSAM™ file manager, MAGSAMX™ tutorial program, MAGSAMD™ file dump utility, User Guide, Reference Card, and one year update service.

Select the version of MAGSAM™ that meets your requirements. All versions of MAGSAM™ are completely upward compatible and may be upgraded at any time for the price difference.

- **MAGSAM III™** — Most advanced version. Multiple Key support (any number of keys), and Record and Key Deletion with automatic reclamation of disk space. . . . . **$145†**
- **MAGSAM II™** — Single Key support with full Delete capability . . . . . **$99†**
- **MAGSAM I™** — Entry level version. Single Key support without Delete capability. . . . . **$75†**
- User Guide only - comprehensive tutorial and reference manual. **$15**

Available for 8" soft sector, Micropolis, and TRS-80 disk formats. Requires CP/M* or derivative and CBASIC. Distributed as CBASIC subroutines in source form.

Visa and Masterchagre welcome. Dealer and OEM inquiries invited.

MAG **MICRO APPLICATIONS GROUP**
7300 CALDUS AVENUE
VAN NUYS, CA 91406

M103

* Trademark of Digital Research † Single site license

✓ Reader Service—see page 179

NEECO PROUDLY ANNOUNCES THE COMPUTHINK MINIMAX

"FULLY INTEGRATED COMPUTER SYSTEM"

MINIMAX SERIES COMPUTER

THE MINIMAX SERIES WAS DESIGNED TO OFFER THE MARKET MINICOMPUTER CAPABILITIES AT MICROCOMPUTER PRICES. COMPARE THE CAPABILITIES & PRICE!

CONTACT NEECO FOR FULL SPECS - FREE MINIMAX MANUAL.

MEET THE MINIMAX COMPUTER

THE MINIMAX SERIES COMPUTER WAS DESIGNED BY INDUSTRY PROFESSIONALS. COMPARE THE PRICE AND FEATURES TO ANY OTHER COMPUTER IN ITS CLASS!

MINIMAX I - .8 MEGABYTE ON LINE MINIFLOPPY STORAGE
MINIMAX II - 2.4 MEGABYTE ON LINE 8" FLOPPY STORAGE

MINIMAX I -	**$4495**
MINIMAX II -	**$5995**

PRINTER NOT INCLUDED IN PRICE

• THE MINIMAX SERIES COMPUTER IS AN INTEGRATED, COMPACT UNIT CONTAINING THE CPU, DUAL DENSITY DISK STORAGE, 12 INCH CRT, AND FULL STYLE KEYBOARD, WITH SEPARATE NUMERIC ENTRY PAD. ALL KEYS (INCLUDING CURSOR) WITH FULL REPEAT • HYBRID 2 MEGAHERTZ 6502 CPU • 108K SYSTEM RAM (48K USER) • FASTEST FLOPPY DISK ACCESS (24K LOADS IN 4.2 SECONDS) • 16K ROM CONTAINS COMPUTHINK BASIC (AN EXTENDED MICROSOFT BASIC) WITH EXTENDED PRECISION. DOS INCLUDES COMPLETE FILE I/O WITH FULL RANDOM ACCESS, COMPLETE MONITOR WITH DEBUG & TRACE, AND TINY 6502 ASSEMBLER • COMPLETE HIGH RESOLUTION GRAPHICS WITH INDIVIDUAL DOT (240 x 512) POINT SCREEN ADDRESSABILITY • FULL SCREEN TEXT EDITING WITH OVERWRITE, INSERTION OR DELETION • SPLIT SCREEN/WINDOW MODES • INDIVIDUAL FIELD EDITING WITH FIELD PROTECT AND AUTO SKIP TO NEXT FIELD • DISK STORAGE SYSTEM TRANSFERS 6K PER SECOND WITH AUTO VERIFY AND PARITY CHECK • 12 INCH CRT-64 CHARACTERS BY 30 LINES UP TO THREE PROGRAMMABLE CHARACTER FONTS FOR LANGUAGES OR SPECIAL CHARACTERS • • • SWITCHABLE 110 OR 220V OPERATION • • • • HYBRID CPU IS MICROPROGRAMMABLE WITH 64 USER DEFINABLE OPCODES. CHOICE OF 800K OR 2.4 MEGABYTE DISK STORAGE • FULL SERIAL RS-232C PORT WITH PROGRAMMABLE BAUD RATES AND MODEM CONTROL SIGNAL • DEDICATED DISK PORT • PRINTER PORT SUPPORTS PARALLEL COMMERCIAL PRINTERS • 24 PIN I/O USER PORT • PAGEMATE DATABASE AVAILABLE • PLM COMPILER AVAILABLE • BUSINESS PACKAGES AVAILABLE • COMPLETE DIAGNOSTICS & SCHEMATICS INCLUDED • COMPLETE USER MANUAL INCLUDED

SPECIAL DEALER PRICING AVAILABLE ON DEMONSTRATION MINIMAX AND SOFTWARE PACKAGES TO QUALIFIED SELECTED DEALERS. CONTACT NEECO FOR INFO.

THE MINIMAX WAS DESIGNED AND IS MANUFACTURED BY COMPUTHINK COMPUTER CORP. DISTRIBUTED IN EUROPE AND THE EASTERN U.S. BY NEECO.

IN ADDITION TO HARDWARE CAPABILITIES THAT ARE UNMATCHED IN THE INDUSTRY, THE MINIMAX COMPUTER SUPPORTS A COMPLETE DATA BASE SYSTEM (PAGEMATE), CONTAINING FULL STATISTICAL, SORTING, AND EDIT FUNCTIONS. A PLM COMPILER IS AVAILABLE, FULL BUSINESS SUPPORT SOFTWARE IS AVAILABLE AND MORE!—FULL DEALER SUPPORT IS AN IMPORTANT PART OF OUR MARKETING. CONTACT NEECO FOR FURTHER INFORMATION.

THE MINIMAX IS NOW AVAILABLE FOR QUANTITY DELIVERY. DOMESTIC DEALERSHIPS AVAILABLE. EUROPEAN DISTRIBUTORSHIPS/DEALERSHIPS AVAILABLE TO QUALIFYING COMPANIES WITH SUPPORT CAPABILITIES. SOFTWARE HOUSES AND OEM INQUIRIES INVITED. CONTACT NEECO.

NEECO

NEW ENGLAND ELECTRONICS CO., INC.
679 HIGHLAND AVE., NEEDHAM, MA 02194
MON-FRI, 9:00-5:30, E.S.T.

✓N12

(617) 449-1760

TELEX 951021, ANSWERBACK "NEECO"

✓ *Reader Service—see page 179*

The Fastest, Most Cost-Effective North Star Business Software Available . . . Period!

We offer features that no one else has, at any price. For example:

GENERAL LEDGER 2.4

- Uses standard double entry accounting methods.
- Uses our Skip Sequential™ file structure for fast posting and efficient use of disk space (see May, 1979 KILOBAUD, page 16).
- Direct cursor control for the SOL, SOROC, ADM-3 and ADDS-100 video systems. (Standard version for all other video systems.)
- Custom Chart of Accounts with full editing. (A system with 16K of user memory will support over 200 accounts.)
- Posting by account name, number, OR both.
- Printer output routines for Income Statement, Balance Sheet, Data files and other reports.
- Can be used by CPA's on a "one-disk-per-client" basis (specify CPA version when ordering).
- All programs are parameter-driven to avoid repetitive inputs.
- Operator's manual designed for the user with no computer experience.
- A total of 18 programs for the ultimate in user flexibility.
- Price; only $99.95!

We also have A/R, A/P, Payroll and the most comprehensive statistics package available anywhere. All programs use North Star Release 4 or 5 DOS and BASIC, single or double density. Operator's manuals available for $5.00 (credited towards purchase). Please specify video system when ordering.

master charge THE INTERBANK CARD

ECOSOFT ✓E34
P.O. Box 68602 Indianapolis, IN 46268

The Independent Newsletter of Heath Co. Computers

The independence of Buss is a crucial factor in its significance to users (and prospective users) of Heath Co. computers. Information on new products is presented to Buss readers as it leaks out of Benton Harbor, not held back to suit the marketing plans of the manufacturer. For example, word that Heath Co. was working on the H19 terminal based on the Z80 microprocessor appeared well over a year ago in the February 1978 Buss. News of compatible hardware and software from other venders is also featured.

Buss is not a company-controlled publication, so it can deal with the weaknesses of Heath Co. computer products as well as their strengths. Buss emphasizes candid accounts of owners' experiences with their computers. Their discoveries save subscribers headaches--and money. That's the proven record of over two years of publication. So Buss can guarantee a full refund any time you're not satisfied.

Buss is mailed first class (by airmail outside North America). The 24-issue subscription gives you the choice of starting with the latest issue or with available back issues (about eight are still in stock). Send $8.20 for 12 issues or $15.40 for 24 (overseas, $10.50/12; $20.00/24 payable on a U.S. bank) to:

Buss ✓B43
325-K Pennsylvania Avenue, S.E.
Washington, DC 20003

SMALL SOFTWARE SYSTEM TRS-80 PRODUCTS SMALL SOFTWARE SYSTEM

✓S51

ADVENTURE 1 - ADVENTURELAND - $14.95 each or
ADVENTURE 2 - PIRATE'S ADVENTURE - all three for
ADVENTURE 3 - MISSION IMPOSSIBLE - only $39.95.

Machine language versions of Adventure, the current rage of the big time-sharing computers! 100+ word vocabulary! 30 rooms and locations. A challenge that can take weeks to solve! LEVEL-II 16K.

RSM-1S: A MACHINE LANGUAGE MONITOR FOR 4K TRS-80'S - $23.95
RSM-2: AN ADVANCED MONITOR FOR 16K TRS-80'S - 26.95
RSM-2D: THREE MONITORS FOR TRS-80 DISK SYSTEMS - 29.95

22 commands to control your TRS-80 Z-80 processor! Examine ROM's, test RAM, program in machine language, read/write machine language tapes, and much more! A SYMBOLIC DUMP command disassembles memory into Z-80 mnemonics! Display memory in HEX or two ASCII formats, or EDIT, MOVE, EXCHANGE, VERIFY, FILL, ZERO, TEST, or SEARCH your memory! RSM-2/2D include all above features, plus read/write SYSTEM tapes, enter BREAKPOINTS, PRINT with our TRS232 or the expansion interface, and read/write disk sectors directly! RSM-2 loads at the top of 16K LEVEL I or II. RSM-2D, furnished on disk, has 3 versions for 16K, 32K and 48K.

BASIC-1P - LEVEL-1 BASIC WITH PRINTING! - $19.95

Run any LEVEL-1 BASIC tape (12K or less) in 16K LEVEL-II TRS-80 without conversion! Plus LLIST and LPRINT for TRS232, RS-232-C or Centronics printers. LPRINT ON and LPRINT OFF prints anything that you see on the screen! All LEVEL-I abbreviations and functions supported.

BARRICADE: MACHINE LANGUAGE ACTION GAME FOR TRS-80'S - $14.95

Break through 5-wall Barricade with high-speed ball and keyboard controlled paddle! Trap the ball among the walls and watch it destroy the 100 blocks! Select 96 different options to challenge experts and beginners. 3 scores with the best of each saved to be challenged by other players. NOBODY can achieve the maximum WEIGHTED SCORE of 33,000! 4K LEVEL-I and II.

AIR RAID: MACHINE LANGUAGE TRS-80 SHOOTING GALLERY! - $14.95

Shoot down high speed aircraft with a ground based missile launcher! Aircraft explode dramatically when hit, sometimes destroying other nearby planes! Score is tallied for each hit or miss, and the highest score is saved to be challenged by other players. Hours of fun for you, and a super demonstration program for entertaining friends! 4K LEVEL I and II.

* CALIFORNIA RESIDENTS ADD 6 PER CENT SALES TAX *
* SMALL SYSTEM SOFTWARE * P.O. BOX 366 * NEWBURY PARK, CALIF. 91320 *

TRS232 PRINTER INTERFACE - $49.95 (+$2.00 shipping)

Assembled and tested output port for TRS-80 printing. Use any RS-232 or 20-mil current loop ASCII printer. Expansion interface not required. Use with LEVEL-II BASIC, CP/M, BASIC-1P, ELECTRIC PENCIL, RSM-2/2D or your own programs! Standard cassette software included, or order new "FORMATTER" for $9.95 with TRS232 (see below).

TRS232 "FORMATTER" SOFTWARE PACKAGE - $14.95

Page and line length control, form feed function, printer pause, 9 baud rates, "smart" line termination, built-in keyboard debounce, software control of screen printing, etc. $9.95 if ordered with TRS232.

THE ELECTRIC PENCIL FOR TRS-80 DISK SYSTEMS - $150.00
THE ELECTRIC PENCIL FOR TRS-80 TAPE SYSTEMS - 99.95

Write text, delete, insert, or move words, lines or paragraphs, save text on tape (or disk), then print formatted copy with our TRS232 or Centronics printer (RS-232-C with disk version). Right justification, page titling and numbering, transparent cursor and repeating keyboard. Lowercase entry and display with minor modification. LEVEL-I or II 16K (Tape version).

CP/M OPERATING SYSTEM WITH TRS232 SOFTWARE - $145.00

SMALL SYSTEM SOFTWARE/LIFEBOAT ASSOCIATES version of CP/M. Includes TRS232 and RS-232-C software, lower-case support, debounce, plus DCV-2 and other unique utilities. CP/M Editor creates and modifies all files. Files may be much longer than your memory! Assemble directly from disk, placing HEX and PRINT files back onto disk! Includes DDT (Dynamic Debugging Tool), PIP (Peripheral Interchange Program), and more! 16K single disk required, 32K dual disk recommended.

DCV-1: CONVERT SYSTEM PROGRAMS TO DISK FILES - $9.95

Execute Adventure, Barricade, Air Raid, RSL-1, ESP-1, T-BUG, etc., from disk, even if they interfere with TRSDOS! After using DCV-1, your program loads from disk into high memory, moves itself to its correct address, then jumps there and executes!

OTHER TRS-80 PRODUCTS

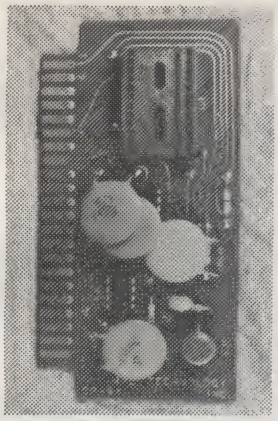
ESP-1: $29.95 Editor, assembler, and monitor using INTEL 8080 mnemonics.
RSL-1: 14.95 Draw patterns, then play Conway's LIFE in machine language.
LST-1: 8.00 A disassembled listing of LEVEL-1 BASIC with some comments.

* SMALL SYSTEM SOFTWARE * P.O. BOX 366 * NEWBURY PARK, CALIF. 91320 *

✓ Reader Service—see page 179

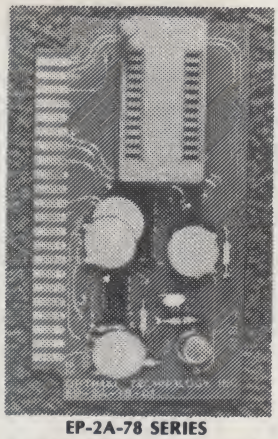
✓ Reader Service—see page 179

EPROM PROGRAMMERS



EP-2A SERIES

- PROGRAMS 2708 and 2716 EPROMS
- Price $59.95 Assembled and Tested
- Kit price $49.95
- Includes Connector



EP-2A-78 SERIES

- PROGRAMS 2708, 2716, 2758, TMS 2716 and TMS 2532 EPROMS
- TEXTOOL ZERO FORCE SOCKET
- Price $79.95 Assembled and Tested
- Includes Connector

Software available for the Rockwell AIM-65, MOS Technology KIM-1, Synertek SYM-1, Motorola D2, RCA VIP and many other single board computers that use the 6502, 6800, 8080/85, Z-80, 1802, F-8 and 2650 CPU's. Stock. Specify one set of software.

Optimal Technology Inc.
✓010 Blue Wood 127
Earlysville, VA 22936 U.S.A.
Phone (804) 973-5482

TRS-80 ATARI PET APPLE

THE RECREATIONAL PROGRAMMER™

QUALITY SOFTWARE!
TI & HP Programmables
BASIC for most computers

GAMES·ALGORITHMS·PUZZLES
STOCK ANALYSIS· AND MORE!

OVER 30 PAGES BIMONTHLY!

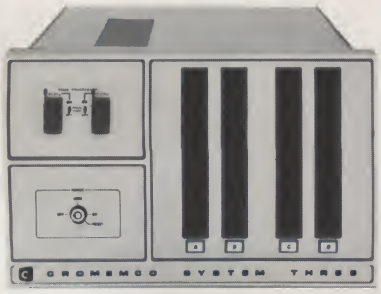
ANNUAL SUBSCRIPTION ONLY:
$12 within USA & APO/FPO's
$24 Foreign by AIRMAIL
Single issue for $3 incl P&H

VISA and MASTERCHARGE OK!
CALL (616) 343·3546 NOW!
Box 2571 Kalamazoo MI 49003

DISCOUNT PRICES

Microcomputers & Peripherals

BITS
YTES
OOKS
ARGAINS



Cromemco • SWTPC • Lear-Siegler
Hazeltine • RCA • North Star
Verbatim • Perkin Elmer and others

Fast, off the shelf delivery.
Call TOLL FREE 800/523-5355

MARKETLINE SYSTEMS, Inc. ✓M17
2337 Philmont Ave., Huntingdon Valley, Pa. 19006
215/947-6670 • 800/523-5355
Dealer Inquiries Invited

TRS-80 means business! ! !
...with CP/M, CBASIC2, & applications software.

CP/M ("the software bus") & CBASIC2 (the standard for business software) bring new power and versatility to the TRS-80 for practical use.

CP/M Operating System (w/Editor, Assembler, Debugger, Utilities & 6 manual set) **$150**
CBASIC2 Compiler (w/manual) . . . . . **$ 95**
DESPOOL Print Spooler (w/manual) . . . . . **$ 75**

*Osborne & Assoc. **PAYROLL W/COST ACCTNG** **$250**
*Osborne & Assoc. **ACCTS. RECEIVABLE & ACCTS. PAYABLE** **$250**
*Osborne & Assoc. **GENERAL LEDGER**. **$250**

*=CBASIC2 source programs; add $15 (each) for applicable O & A book.

APH - Self-administered Automated Patient History. **$175**

Write/call for additional software available & FREE "CP/M Primer".

CA residents add 6% tax. Visa, M/C,M/O,Check OK.

CYBERNETICS IN C ✓C129 (714) 848-1922
8041 NEWMAN AVENUE • SUITE 208 • HUNTINGTON BEACH, CALIFORNIA 92647

Boards or Complete Systems . . .

The best price and delivery is from MiniMicroMart!

CROMEMCO Model 3703 Line Printer

– 180 cps, 132 cols., 18" platen, bi-directional printing, List $2995 OUR PRICE **$2545**

3101 CRT Terminal

– 80-char. line, 24 lines, upper/lower case, List $1995 OUR PRICE **$1695**

CROMEMCO DISK SOFTWARE

BASIC, Fortran, Assembler, Cobol, Word Processing System, Data Base Management – all complete with the new CDOS disk operating system, fully CP/M® compatible, List $95 ea.

OUR PRICE **$85** EACH

Multiple User Basic, List $800 . . . . . **$680**

Z-2 Computer System for rack mounting, Z-80 processor, P.S., Assem. & Tested, incl. fan, edge connectors . . . . . OUR PRICE **$845**

Z-2D Disk Computer System – Similar to Z-2 but comes w/floppy disk controller and minifloppy disk drive, A&T ($2095) . . **$1780**

MEMORY BOARDS

MiniMicroMart is your best source for all the leading S-100 memory boards —

New North Star 32K RAM Board
with parity – Kit, List $599 . . . . . **$499**
Assem. and Tested, List $659 . . . . . **$549**

Super Buy on 16K Static Board
4 MHz, 16K Problem Solvers, A&T **$319**

New Super 64K Dynamic Board
from Measurement Control Systems, full one-year warranty, fully socketed, available partially populated, A&T:
Complete w/all 64K, List $795 . . . . . **$659**
Populated with 48K, List $695 . . . . . **$589**
Populated with 32K, List $595 . . . . . **$509**

SD Computer 32K Dynamic ExpandoRam Kit **$329**

Morrow SuperRam® 32K Static
4 MHz, Assm. & Tested, List $699 . . . . **$629**

Dynabyte 16K Static, 4 MHz
A&T, 1-yr. warranty, MSC-1625 . ONLY **$359**

CROMEMCO BOARDS

4 MHz Single Card Computer
Assembled & Tested, List $450 . . . . . **$385**

16K RAM Card with Bank Select
Assem. & Tested, List $595 . . . . . **$495**

Bytesaver PROM Board and PROM Programer, Kit, without PROM ($145) **$125**
Assem. & Tested, List $245 . . . . . **$210**

TU-ART Digital Interface, Kit ($195) **$165**
Assem. & Tested, List $295 . . . . . **$250**

Disk Controller Card, Kit, List $395 . **$335**
Assm. & Tested, List $495 . . . . . **$399**

BUSINESS SYSTEM USERS

Need high-density storage???

Contact us about price and delivery on the fabulous **Cromemco 11-megabyte hard-disk systems – Z-2H and HDD**

Also – on the **Quad-density North Star Horizon Floppy System!**

CROMEMCO SYSTEM 3

List $5990 OUR PRICE **$4990**

Features 4 MHz CPU, 32K of RAM, dual PerSci floppy disk drives (and provision for installing two additional drives), RS232C Interface, Printer Interface – assembled and tested, ready to use.

With 64K of RAM, List $6585 . . . . **$5485**

CROMEMCO SYSTEM 2

Similar to above, but with minifloppy drives and now including 64K of RAM.
List $3990 . . . . . **$3390**

Now Delivering North Star Double-Density Horizon with 32K RAM Board!

Horizon I, Kit, List $1849 . . . . . **$1559**
Assem. & tested, List 2099 . . . . . **$1779**

Horizon II, Kit, List $2249 . . . . . **$1909**
Assem. & Tested, List 2549 . . . . . **$2159**

16K Double-Density models still available at super low prices. . .

Horizon I, Kit, List $1599 . . . . . **$1349**
Assem. & Tested, List $1899 . . . . . **$1599**

Horizon II, Kit, List $1999 . . . . . **$1699**
Assem. & Tested **$1939**

Famous North Star Double-Density Mini Disk Floppy Disk Interface
Kit, List $699 . . . . . OUR PRICE **$589**
Assm. & Tested, List $799 . . . . . **$674**

SHIPPING, HANDLING & INSURANCE: Add $2 for boards, $6 for floppy disk systems, $12 for Horizons. Assembled Cromemco systems shipped freight collect.

All prices subject to change and all offers subject to withdrawal without notice.

— WRITE FOR FREE CATALOG —

MiniMicroMart, Inc.

M6

168 James St., Syracuse NY 13203 (315) 422-4467 TWX 710-541-0431

P.O. Box 4430M Santa Clara, CA 95054
For will call only: (408) 988-1640
2322 Walsh Ave.

Quest ELECTRONICS

Q3

Same day shipment. First line parts only. Factory tested. Guaranteed money back. Quality IC's and other components at factory prices.

RCA Cosmac Super Elf Computer $106.95

Compare features before you decide to buy any other computer. There is no other computer on the market today that has all the desirable benefits of the **Super Elf** for so little money. The Super Elf is a small single board computer that does many **big** things. It is an excellent computer for training and for learning programming with its machine language and yet it is easily **expanded** with **additional memory, Tiny Basic, ASCII Keyboards, video character generation, etc.**

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are decoded and displayed on eight LED indicator lamps.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, wait, input, memory protect, monitor select** and **single step**. Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector for PC cards and a 50 pin connector for the **Quest Super Expansion Board**. Power supply and sockets for **all** IC's are included in the price plus a detailed 127 pg. instruction manual which now includes over 40 pgs. of software info. including a series of lessons to help get you started and a music program and graphics target game.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Cabinet** with drilled and labelled plexiglass front panel **$24.95. NiCad Battery Memory Saver Kit $6.95.** All kits and options also come completely assembled and tested.

Questdata, a 12 page monthly software publication for 1802 computer users is available by subscription for $12.00 per year.

Attention Elf Owners

New products in hardware and software coming soon.

Tiny Basic cassette $10.00, on ROM $38.00, original Elf kit board $14.95.

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow **you** to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface**. Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf**. The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed.** EPROM can be used for the monitor and Tiny Basic or other purposes.

A 1K Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatible cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. The Super Monitor is written with subroutines allowing users to take advantage of monitor functions simply by calling them up.

Improvements and revisions are easily done with the monitor. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports** with **full handshake**. They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. A Godbout 8K RAM board is available for $135.00. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50. A 50 pin connector set** with ribbon cable is available at $12.50 for easy connection between the **Super Elf** and the **Super Expansion Board.**

The **Power Supply Kit** for the Super Expansion Board is a 5 amp supply with multiple positive and negative voltages $29.95. Add $4.00 for shipping. Prepunched frame $5.00. Case $10.00. Add $1.50 for shipping.

INTEGRATED CIRCUITS

7400TTL

7400N	17	LM379M	5 00
7402N	17	LM380N	1 00
7404N	19	LM381	1 60
7409N	23	LM382	1 60
7410N	17	LM703H	40
7414N	63	LM709H	28
7420N	17	LM723H/N	50
7422N	1 39	LM733N	67
7430N	20	LM741CH	35
7442N	50	LM741N	25
7445N	69	LM747H/N	62
7447N	60	LM748N	35
7448N	69	LM1303N	82
7450N	17	LM1304	1 10
7474N	29	LM1305	1 27
7475N	49	LM1307	2 00
7486N	88	LM1310	2 75
7489N	2 00	LM1458	47
7490N	43	LM1800	1 75
7492N	43	LM1812	7 50
7493N	43	LM1889	3 00
7495N	69	LM2111	1 75
74100N	90	LM2902	1 50
74107N	29	LM3900N	60
74121N	34	LM3905	1 75
74123N	59	LM3909N	61
74125N	39	MC1458V	50
74145N	69	NE550N	65
74150N	95	NE555V	43
74151N	69	NE556A	79
74154N	1 00	NE565A	1 00
74157N	69	NE566V	1 50
74161N	87	NE567V	1 20
74162N	87	NE570B	5 00
74163N	87	NE571B	5 00
74174N	96	78L05	60
74175N	90	78L08	60
74190N	1 15	79L05	70
74192N	87	78M05	85
74193N	85	75108	1 75
74221N	1 55	75491CN	50
74298N	1 65	75492CN	55
74365N	95	75494CN	89
74366N	95		
74367N	95	**A to D CONVERTER**	
		80388	4 50

74LS00 TTL

74LS00N	25	8700CJ	13 95
74LS02N	25	8701CN	15 95
74LS04N	25	8750CJ	13 95
74LS08N	25	LD130	9 95
74LS10N	25	9400CJV/F	7 40
74LS13N	40	ICL7103	9 50
74LS14N	90	ICL7107	14 25
74LS20N	25	8702	17 95
74LS22N	25		
74LS28N	41	**CMOS**	
74LS30N	25	CD34001 Pair	50
74LS33N	39	CD4000	16
74LS38N	30	CD4001	21
74LS74N	1 15	CD4002	21
74LS75N	47	CD4006	1 10
74LS90N	51	CD4007	21
74LS93N	51	CD4008	21
74LS95N	1 89	CD4009	39
74LS107N	35	CD4010	39
74LS112N	35	CD4011	21
74LS113N	35	CD4012	21
74LS132N	72	CD4013	36
74LS136N	35	CD4014	86
74LS151N	67	CD4015	86
74LS155N	67	CD4016	36
74LS157N	67	CD4017	94
74LS162N	91	CD4018	94
74LS163N	91	CD4019	21
74LS174N	95	CD4020	1 02
74LS190N	1 06	CD4021	1 02
74LS221N	1 95	CD4022	86
74LS258N	67	CD4023	21
74LS367N	1 35	CD4024	75
		CD4025	21
LINEAR		CD4026	1 51
CA3045	90	CD4027	36
CA3046	67	CD4028	79
CA3081	1 80	CD4029	1 02
CA3082	1 90	CD4030	21
CA3089	2 95	CD4035	1 02
LM301AN,AH	35	CD4040	1 02
LM305H	87	CD4042	71
LM307N	35	CD4043	63
LM308N	89	CD4044	63
LM309H	1 15	CD4046	1 67
LM309K	1 50	CD4047	36
LM311H/N	90	CD4050	36
LM317T-K	2 92	CD4051	1 13
LM318	1 35	CD4052	1 42
LM320K-5	1 60	CD4053	1 42
LM323K-5	6 95	CD4060	1 42
LM320K-12	1 60	CD4066	71
LM320K-15	1 60	CD4068	40
LM320T-5	1 60	CD4069	40
LM320T-8	1 60	CD4070	40
LM320T-12	1 50	CD4071	21
LM320T-15	1 60	CD4072	21
LM324N	1 15	CD4073	21
LM339N	1 55	CD4075	21
LM340K-5	1 35	CD4076	1 75
LM340K-8	1 35	CD4078	40
LM340K-12	1 35	CD4081	21
LM340K-15	1 35	CD4082	21
LM340K-24	1 35	CD4116	47
LM340T-5	1 25	CD4490	5 50
LM340T-8	1 25	CD4507	1 00
LM340T-12	1 25	CD4508	4 25
LM340T-15	1 25	CD4510	1 02
LM340T-18	1 25	CD4511	94
LM340T-24	1 25	CD4515	2 52
LM343H	4 50	CD4516	1 10
LM350	7 50	CD4518	1 02
LM370	1 15	CD4520	1 02
LM377	3 00	CD4527	1 51
		CD4528	79
		CD4553	3 50
		CD4566	2 25
		CD4583	4 50

CD4585	1 10		
CD40192	3 00		
74C00	28		
74C04	33		
74C10	28		
74C14	2 10		
74C20	28		
74C30	28		
74C48	1 95		
74C74	75		
74C76	1 40		
74C90	1 15		
74C93	1 40		
74C154	3 00		
74C160	1 44		
74C175	1 35		
74C192	1 65		
74C221	2 00		
74C905	3 00		
74C906	75		
74C914	1 95		
74C922	5 50		
74C923	5 50		
74C925	6 95		
74C926	6 95		
74C927	6 95		
		UART/FIFO	
INTERFACE		AY5-1013	5 50
8095	95	AY5-1014	7 50
8096	95	3341	6 95
8097	95		
8098	95		
8T09	1 25	**PROM**	
8T10	4 50	1702A	3 95
8T13	3 00	N82S23	2 95
8T20	5 50	N82S123	3 50
8T23	3 10	N82S126	3 75
8T24	3 50	N82S129	3 75
8T25	3 20	N82S131	3 75
8T26	1 69	N82S136	8 75
8T28	2 75	N82S137	8 75
8T97	1 69	2708	10 50
8T98	1 69	DM8577	2 90
		8223	2 90
MOS/MEMORY RAM		2716T1	29 50
2101-1	3 95	2716 Intel	48 00
2102-1	95		
2102AL-4	1 60	**CRYSTALS**	
2112L-1	1 18	1 MHz	4 50
21F02	1 25	2 MHz	4 50
2104A-4	4 95	4 MHz	4 25
2107B	4 95	5 MHz	4 25
2111-1	3 75	10 MHz	4 25
2112-2	3 95	18 MHz	3 90
2114L-3	6 75	20 MHz	3 90
4116	10 95	32 MHz	3 90
2513B	6 30	32768 MHz	4 00
MM5262	40	1 8432 MHz	4 50
MM5280	3 00	3 5795 MHz	1 20
MM5320	9 95	2 0100 MHz	1 95
MM5330	5 94	2 097152 MHz	4 50
PD411D-2	4 00	2 4576 MHz	4 50
PD411D-4	5 00	3 2768 MHz	4 50
P5101L	13 95	5 0688 MHz	4 50
4200A	9 95	5 185 MHz	4 50
82S25	2 95	5 7143 MHz	4 50
91L02A	1 50	6 5536 MHz	4 50
HD0165-5	6 95	14 31818 MHz	4 25
MM5740	4 50	18 432 MHz	4 50
GIAY38500-1	9 95	22 1184 MHz	4 50
MCM6571A	9 95		
9368	3 50	**CONNECTORS**	
4100	10 00	44 pin edge	2 75
416	16 00	100 pin edge	4 50
		100 pin edge WW	4 75
CLOCKS			
MM5309	3 00	**KEYBOARD ENCODERS**	
MM5311	3 60	AY5-2376	$12 50
MM5312	4 80	AY5-3600	13 50
MM5313	3 60	74C922	5 50
MM5314	3 90	74C923	5 50
MM5315	4 00	HD0165-5	6 95
MM5316	5 00		
MM5318	3 60		
MM5369	2 10	**IC Test Clips**	
MM5841	14 45	1	10
MM5865	7 95	Red 55	47
CT7001	5 80	Black 55	47
CT7002	10 95		
CT7010	8 95	**Keyer** 8043	14 50
CT7015	8 95	comp w/spec / sock	
MM5375AA/N	3 90		
MM5375AB/N	4 90	**TRANSISTORS**	
7205	16 50	2N1893	40
7207	7 50	2N2222A	18
7208	15 95	2N2369	30
7209	4 95	2N2904A	20
DS0026CN	3 75	2N2907A	25
DS0056CN	7 75	2N3053	40
MM53104	2 50	2N3638	25
		2N3643	25
MICROPROCESSOR		2N3904	18
6800	17 50	2N3906	18
6802	24 95	2N3055	69
6808A with data	8 95	2N4400	25
8085	27 00	2N4401	25
780A	19 75	2N4402	20
8212	2 90	TIP31	60
8214	8 00	TIP33A	1 00
8216	2 90		
8224	2 90	**O Connectors RS232**	
8228	5 35	25 Pin Subminiatures	7700
8251	8 50	DB25P	2 95
8253	10 00	DB25S	3 95
8255	9 25	Cover	1 50
8257	19 50	RS232 Complete Set	6 50
8259	19 50	DE9P	1 50
1802CP plas	13 95	DE9S	1 95
1802DP plas	17 95	DA15P	2 10
1861P	11 50	DA15S	3 10
CDP1802CD	19 95		
CDP1802D	25 00		
CDP1861	12 95		
6820	9 95		
6850	12 95		
6502	12 50		

IC SOCKETS

Solder Tin Low Profile

PIN	1 UP	PIN	1UP
8	15	22	30
14	14	24	35
16	16	28	42
18	27	36	58
20	29	40	57

3 level wire wrap gold
14 pin 25
2 level 14 pin ww 20

WIRE WRAP LEVEL 3

PIN		PIN	
14	25	24	86
16	33	28	1 00
18	57	40	1 23

CLOCK MODULES Complete alarm clocks ready to hook up with transformer and switches. Very compact with .50" and .84" digits

MA1002A, C or E .50"	**8.95**
102P3 Transformer	**2.25**
MA1010A, C or E .84"	**11.95**
102P2 Transformer	**2.25**
Special transformer and six switches when purchased w/module	**2.95**
MA1003 car module .3" green floor display	**15.95**

RESISTORS ¼ watt 5%
10 per type .03 1000 per type .012
25 per type .025 350 piece pack
100 per type .015 5 per type 6.75

KEYBOARDS

56 key ASCII keyboard kit	$67.50
Fully assembled	77.50
53 key ASCII keyboard kit	60.00
Fully assembled .70 00 Enclosure	14.95

LEDS

Red T01¾	15
Green, Yellow T01¾	20
Jumbo, Red	20
Green, Orange, Yellow Jumbo	25
Cliplite LED Mounting Clips .8/$1.25 (specify red, amber, green, yellow, clear)	

CONTINENTAL SPECIALTIES in stock
Complete line of breadboard test equip
MAX-100 8 digit Freq. Ctr. $128.95
DK WIRE WRAP TOOLS in stock
Portable Multimeter $19.00
DIGITAL THERMOMETER $48.50
Batt. oper. General purpose or medical 32 –230 F. Disposable probe cover – 2° accuracy. Comp. Assy. in compact case. Switches from F to C

COMPUTER BOARD KITS

8K RAM Board Kit	$135.00
4K EPROM Kit	114.95
I/O Board Kit	44.50
Extender Board w/connector	12.50
16K EPROM board kit w/o PROMS	74.50
North Star Floppy Disk Kit	$665.00
Additional Drive Kit	415.00

SPECIAL PRODUCTS

MM5865 Stopwatch Timer	9 00
PC board	7 50
Switches Mom. Pushbutton	27
3 pos. slide	25
Encoder HD0165-5	6 95
3 Digit Universal Counter Board Kit	
Operates 5–18 Volt DC to 5 MHz typ. 125" LED display	**10.50**
Voice actuated switch	50
Paratronics 100A Logic Analyzer Kit	$235 00
Model 10 Trigger Expander Kit	$229.00
Model 150 Bus Grabber Kit	$369.00
Sinclair 3½ Digit Multimeter	**$59.95**
Clock Calendar Kit	**$23.95**

TRANSFORMERS

6V 300 ma	3 25
12 Volt 300 ma transformer	1 25
12 6V CT 600 ma	3 75
12V 250 ma wall plug	2 95
12V CT 250 ma wall plug	3 50
24V CT 400 ma	3 95
10V 1 2 amp wall plug	4 85
12V 6 amp	12 95

DISPLAY LEDS

MAN1	CA	270	2 90
MAN3	CC	125	39
MAN72/74	CA/CA	300	1 00
DL704	CC	300	1 25
DL707/DL707R	CA	300	1 00
DL727/728	CA/CC	500	1 90
DL747/750	CA/CC	600	1 95
DL750	CC	600	1 95
FND359	CC	357	70
FND500/507	CC/CA	500	1 35
FND503/510	CC/CA	500	90
FND800/807	CC/CA	800	2 20
3 digit Bubble			60
4 digit bubble			80
DG8 Fluorescent			1 75
DG10 Fluorescent			1 75
5 digit 14 pin display			1 00
NSN69 9 digit display			60
7520 Clarrex photocells			39
TIL311 Hex			1 50

COMPUTER GRADE CAPS

1600	mfd	200V	4 50
2000	mfd	45V	2 50
3200		50V	2 50
5500		25V	2 50
5800		40V	3 00
6100		40V	3 00
6100		50V	3 00
7700		50V	2 50
8000		55V	2 50
10000		20V	2 50
12000		30V	3 50
35000		25V	5 00
55000		25V	5 00
82000		15V	6 00
60000		40V	6 00
76000		40V	6 00
120000		10V	6 00

Auto Clock Kit $15.95

DC clock with 4-.50" displays. Uses National MA-1012 module with alarm option. Includes light dimmer, crystal timebase PC boards. Fully regulated, comp. instructs. Add $3.95 for beautiful dark gray case. Best value anywhere.

RCA Cosmac VIP Kit $229.00

Video computer with games and graphics. Fully assem. and test. **$249.00**

Not a Cheap Clock Kit $14.95

Includes everything except case. 2-PC boards. 6-.50" LED Displays. 5314 clock chip, transformer, all components and full instructions. Orange displays also avail. **Same kit w/.80" displays.** Red only. **$21.95** Case **$11.75**

60 Hz Crystal Time Base Kit $4.40

Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy. Kit includes: PC board, IC, crystal, resistors, capacitors and trimmer.

Digital Temperature Meter Kit

Indoor and outdoor. Switches back and forth. Beautiful. 50" LED readouts. Nothing like it available. Needs no additional parts for complete, full operation. Will measure –100° to +200° F. tenths of a degree, air or liquid. Very accurate. **$39.95**
Beautiful woodgrain case w/bezel **$11.75**

NiCad Battery Fixer/Charger Kit

Opens shorted cells that won't hold a charge and then charges them up, all in one kit w/full parts and instructions. **$7.25**

PROM Eraser

Will erase 25 PROMs in 15 minutes. Ultraviolet, assembled **$34.50**

Rockwell AIM 65 Computer

6502 based single board with full ASCII keyboard and 20 column thermal printer. 20 char. alphanumeric display, ROM monitor, fully expandable. $375.00. 4K version $450.00. 4K Assembler $85.00. 8K Basic Interpreter $100.00. Power supply assembled in case $60.00.

Multi-volt Computer Power Supply

8v 5 amp, +18v .5 amp, 5v 1.5 amp, –5v .5 amp, 12v .5 amp, –12 option. ±5v, +12v are regulated. Kit $29.95. Kit with punched frame $34.95. Woodgrain case $10.00.

Video Modulator Kit $8.95

Convert your TV set into a high quality monitor without affecting normal usage. Complete kit with full instructions.

2.5 MHz Frequency Counter Kit

Complete kit less case **$37.50**

30 MHz Frequency Counter Kit

Complete kit less case **$47.75**
Prescaler kit to 350 MHz **$19.95**

79 IC Update Master Manual $35.00

Complete IC data selector, 2500 pg. master reference guide. Over 50,000 cross references. Free update service through 1979. Domestic postage $3.50. Foreign $5.00. 1978 IC Master closeout $19.50.

Stopwatch Kit $26.95

Full six digit battery operated. 2–5 volts. 3.2768 MHz crystal accuracy. Times to 59 min., 59 sec., 99 1/100 sec. Times std., split and Taylor. 7205 chip, all components minus case. Full instructions.

Hickok 3½ Digit LCD Multimeter

Batt/AC oper. 0.1mv–1000v. 5 ranges. 0.5% accur. Resistance 6 low power ranges 0.1 ohm–20M ohm. DC curr. .01 to 100ma. Hand held, ½" LCD displays, auto zero, polarity, overrange. $74.95.

S-100 Computer Boards

8K Static RAM Kit Godbout	$135.00
16K Static RAM Kit	265.00
24K Static RAM Kit	423.00
32K Dynamic RAM Kit	310.00
64K Dynamic RAM Kit	470.00
8K/16K Eprom Kit (less PROMS)	**$89.00**
Video Interface Kit	**$139.00**
Motherboard **$39.** Extender Board	**$8.99**

TERMS: $5.00 min. order U.S. Funds. Calif residents add 6% tax.
BankAmericard and Master Charge accepted.
Shipping charges will be added on charge cards.

FREE: Send for your copy of our NEW 1979 QUEST CATALOG. Include 28¢ stamp.

10-DAY FREE TRIAL

Send for our FREE Catalog

NCE COMPUMART'S PET WAREHOUSE

We have more PETs than anyone, call for quick delivery.

AS LOW AS $595

4K - Keyboard C	$ 595
8K - Keyboard C	$ 795
16K - Keyboard B	$ 995
16K - Keyboard N	$ 995
32K - Keyboard C	$1195
32K - Keyboard B	$1195
32K - Keyboard N	$1195

C — calculator keyboard (only version with tape deck)
B — large business keyboard without graphics symbols
N — large keyboard with graphics symbols

PET ACCESSORIES

Commodore Dual Floppy Disk Drive	$1295.00
New! PET Terminal Package	$69.00
Second Cassette — from Commodore	$95.00
Commodore PET Service Kit	$30.00
Beeper - Tells when tape is loaded	$24.95
Petunia - Play music from PET	$29.95
Video Buffer - Attach another CRT	$29.95
Combo - Petunia and Video Buffer	$49.95
New Serial Printer Interface for PET	$79.95
Integral Data Printer w/new interface	$878.95
PET - Compatible Selectric in Desk	$895.00
TTY KSR-33 Screen Printer for PET SALE!	$395.00
Originate/Answerback Modem for PET	$320.00
Bi-directional RS-232 Interface	$280.00
Betsi 4-slot S-100 Motherboard	$160.00
S-100 PET Interface was $289.00 SALE	$99.00

apple II

$200 FREE ACCESSORIES

Buy a 48K Apple II, mention this ad and take $200 in accessories free (if ordered together). This offer is good for $150 on 32K and $100 on 16K Apple II's. Now you can enjoy more of the best for less.

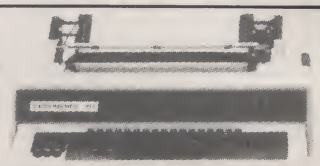
16K Apple II — $1195 (take $100 in free accessories)
32K Apple II — $1345 (take $150 in free accessories)
48K Apple II — $1495 (take $200 in free accessories)

Apple II Accessories

Centronics Printer Interface	$225
Disk and Controller	$595
Second Disk Drive	$495
Parallel Printer Card	$180
Communications Card	$225
Hi-Speed Serial Card	$195
Firmware Card	$200
Hobby/Proto Card	$24
Microverter RF Mod.	$35
Sanyo M2544 Recorder	$55

WHILE THEY LAST

CENTRONICS PRINTERS UP TO 76% OFF LIST



We had purchased an entire truckload of Centronics printers and terminals and when the semi arived we were amazed. Used Centronics were stacked from floor to ceiling and from end to end! We realized that we have to move these terminals and printers fast. So we're offering these reconditioned Centronics at incredibly low prices. However, some models are in limited quantities and the 779 and 703 models are already gone! Call today to get in on this great opportunity.

MODEL	SPEED (1pm)	WIDTH (col's)	PRINT MATRIX		CENTRONICS LIST	WORKING[1] PRICE	90-DAY[2] WARRANTY PRICE
301	70-175	80	5 x 7	Character Elongation	$2,275	$595	$695
306	60-150	80	5 x 7	Character Elongation	2,055	595	695
306C	55-145	80-132	5 x 7	Variable Density	2,360	695	795
306SC	55-145	80-132	Dual	Variable Density	3,950	695	795
308	165	80-132	5 x 7	Teleprinter	3,100	715	815
330	165	80-132	9 x 7	Teleprinter, 96 char.	2,700	550	650
500	40-150	132	5 x 7	Character Elongation	2,995	750	850
500D	120	132-218	5 x 7	Multiple Form	3,200	750	850
501	50-175	132	5 x 7	Character Elongation	3,315	750	850
508	165	132	5 x 7	Teleprinter	4,110	775	875
530	165	132	9 x 7	Teleprinter, 96 Char.	2,950	900	1,000
700	13-90	132	5 x 7	Character Elongation	1,520	660	1,075
701	25-120	132	5 x 7	Char. Elong., Bidirectional	1,815	695	1,175
703	70-370	132	7 x 7	Char. Elong., Bidirectional	2,805	SOLD OUT	
761	60	132	7 x 7	Teleprinter, Bidirectional	1,850	695	1,025
**Model 761 includes Keyboard							
774	21-90	80-132	5 x 7	Variable Density	1,250	SOLD OUT	
780	21-90	80	5 x 7	Character Elongation	1,905	995	1,095
781	43-120	80	5 x 7	Char. Elong., Bidirectional	1,980	995	1,125

All machines require a parallel interface except the 330,530 & 761 models which require serial interfaces.
All machines feature 64 character ASCII code unless otherwise indicated.

1. Guaranteed in working condition when shipped.
2. Comes with a 10-day free trial and our 90-day limited warranty.

INTERFACES AVAILABLE FOR CENTRONICS PRINTERS

TRS-80	Serial versions can use the GPA TRS-80 interface ($69.95 from NCE) or the Radio Shack Expansion unit. Parallel versions use the Radio Shack Expansion unit.
PET	Serial Versions can use the GPA PET interface ($79.95 from NCE).
APPLE	Serial versions can use the Apple Serial Card ($195.00 from NCE). Parallel versions can use the Apple Centronics Card ($225.00 fron NCE).
SORCERER	No hardware is required for serial versions, a cable ($24.95 from NCE) is required for parallel versions.
S-100 COMPUTERS	Cromemco and others make interfaces for both parallel and serial versions of the Centronics Printers.
CRT TERMINALS	Our Centronics Printers can be connected to a Hazeltine 1510 or 1520 with a cable ($50 from NCE). Contact us for use with other terminals.

NCE/CompuMart, Inc.

N7

SELLING COMPUTERS BY MAIL SINCE 1971

1250 North Main Street, Department KB89
P.O. Box 8610 Ann Arbor, Michigan 48107

4% SHIPPING AND HANDLING

(313) 994-3200

MICHIGAN RESIDENTS ADD 4% SALES TAX

10% Additional Handling for Foreign Orders except Canada

Phones open from 9:00 a.m. to 7:00 p.m. EST Monday-Friday, 10:00 a.m. to 5:00 p.m. Saturdays • P.O.'s accepted from D & B rated companies — shipment contingent upon receipt of signed purchase order • Open accounts invited — call for credit application • Most items in stock for immediate shipment — call for delivery quotation • Sorry, no C.O.D.'s • All prices subject to change without notice • In the Ann Arbor area? Retail store open 11:00 a.m. to 7:00 p.m. Tuesday-Friday, 10:00 a.m.to 5:00 p.m. Saturdays (Closed Sunday and Monday)

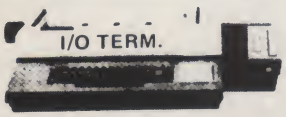
MICROPROCESSOR EQUIP/CASE/KEYBOARD

$28.88 EA.

RUE equipment case originally contained a 9" video monitor & other microprocessor stuff. Good size is suitable for most hobbyist applications - give your minicomputer that professional look! Unit has smoked plastic transluscent screen, 57 key alphanumeric keyboard terminated in 2 14 pin dip connectors (no decoding circuitry, but you can easily add one of the many IC encoder chips available, such as our MCS1007), and anodized aluminum pan in base. Dimensions: case O.D. 17" wdx 22 1/2"dp. x 12" hg.; base pan I.D. 15¾" wd. x 20-7/8" dp. x 1½" space inside case Wd. x 14" dp. x 11½" hg (slopes).
Sh. Wt. 14 Lbs. . . 9110134 . . $28.88
5 for $133.88 . . 9110134. . $133.88/5

POWER SUPPLY KIT

We supply all electrical and electronic parts, you supply labor & mechanical parts, tools, & case.
Battery Charger 12VDC, 20A, 20 Lbs . 7C70005. . . . .(20A) $19.50
Battery Charger 12VDC, 15A, 15 Lbs. 9C0089. . . . . .(15A). $14.50
Ni-Cad Battery Charger Kit, Super Buy! Up to 35VDC, 500Ma. Sh. Wt. 5 Lbs. . . . 7C70243. . . $6.00
Logic P.S. Kit. 5V, 1A. Reg'ted . $6.00 7C70267
5 TO 24VDC Reg'ted & adjustable, 5 amps. Sh. Wt. 15 Lbs. 6MI60301 . . . . . $14.88



IBM/NOVA SELECTRIC

Both ASCII & IBM codes available. Complete ready to go with Microcomputer Interface software & hardware (RS-232 Connector.) Cassett drive premits up to 2400 Baud Data Transfer rate as well as memory typewriter, & use as data entry devise for office use. Comes with Wide carriage, interchangeable balls, unitsccleaned,& adjusted, working.. F.O.B. Peabody.
IBM Corres.Code.....8A30310 $748.00
ASCII code.....8A30311 $888.00

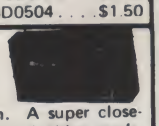
PUNCHED TAPE TAKEUP REEL

This unit operates on 115 VAC; used for taking up all kinds of punched tape. Spool is 10.5" dia., original price was over $100.00. Qty. ltd.
Sh.Wt. 7 lbs.. . . . . 8A8-0328. . . . . $16.88
3 for $47.88 . . . . .8A8-0328 . . . . $47.88/3

ULTRASONIC MOTION DETECTOR

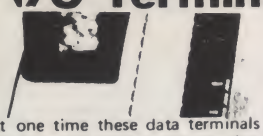
This alarm sensor has up to 50' range and fills the protected area with an energy screen that cannot be seen, felt or heard. Triggers your alarm whenever burglar moves through detector field. Mounts on ceiling, wall desk, shelf etc. Optional delay mode, auto-reset. Operates on 12.5 VDC. A close-out that originally sold for $179.00 3 Lbs. Qty ltd.
8D30336 . . . . . $49.88
ALSO AVAILABLE:
* Power Supply Kit . . .8D0472. . .$3.88
* Connector Kit . . . 8D0504. . . .$1.50

TOUCH SWITCH ALARM



NEW packaged system. A super close-out item. Protects your valuables; gun's, CB's, stereo equipment, test equipment, etc . . . . . List Price $22.88
Sh. Wt 1 Lb . . . . .8MI0474 . . . . .$7.88
3 for $22.88. . . . .8MI0474 . . . $22.88/3

I/O Terminal



At one time these data terminals were used by stock brokers for keeping track of stock quotations. They tied in to a central system which has now been updated, leaving these surplus units behind.

Use this unit as a basis for building your own computer input/output station or to build a compact scope . . . or simply take it apart for the components within.

Sold complete or in parts, prices and descriptions listed below:

† **3" CRT, with Hi-volt. supply** (+3315 vdc; −1730 vdc), and low-volt. supply +440V; +225V; +125V; +28V; +1.2V; +0.6V; 6.3VDC; 6.3VAC. Also - **ramp generator card** & some drive circuits (15 Lbs.) $17.50

† **50 key Block keyboard**, with diode matrix on 2 cards.(5 Lbs.) $12.50

† **Handsome desk-top, slope front case**, suitable for up to an 11" CRT, overall 10½w x16d x9"h,(10 Lbs.) $7.50

† **Plus:** 3 wire line cord, brown, 7'lg for $1.00; 14 wire connector cable for $2.50.

† **COMPLETE UNIT** Sh. Wt. 35 Lbs.
6NB60336 . . . . . $29.95

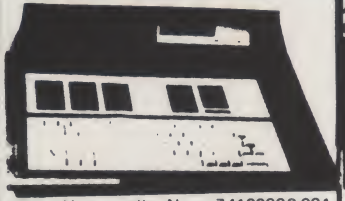
† Also available is a **complete tech. manual** covering operating procedure, theory disassembly (& reassembly), troubleshooting techniques and schematics.

With complete unit - **$1.00** or sold separately for **$3.50** each. Sh. Wt. 8 oz.

WHEN ORDERING:
Specify part, use order no. 6NB60336

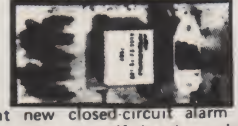
Visit our Retail Stores 119 Foster St., Peabody, Mass. 01960 or our NEWEST store-THE TOWNE PUMP, INC., next to WOOLCO, 777 Willow St., Manchester, New Hampshire.

ASC-11 KEYBOARD CONSOLE



This Honeywell No. 74100903-001 ASC11 encoded microswitch data entry format keyboard. Comes with fully populated I.C. boards. Some 100 I.C.'s, 7100 & 71400 series, or some are dot matrix I.C.,s, LSI chips TMC 4907 - a 4 mhz crystal, a Mostek MK2002, plugs into a wire wrap board of 120 sockets. Also 2-large heat sinks, 4-2N3055 xistors, 2-2N3668, 4-jumper cables with dip plugs attached, 30 lamps No. 382 & other stuff. Power required for keyboard +5VDC, to 12VDC regulated. Pin out supplied for keyboard only. Keyboard in console is a complete assembly ASC11 encoded & is easily removed to fit or use as is. The additional circuitry was used to drive status indicators; Format, program level, check & display etc. Console size: 19" wd.x16"dp.x8" hg. rear, front slopes to 2 3/4"hg. Removed from equipment. Good to excellent condition.
Sh. Wt. 16 Lbs . . . 8W0584. . . .$68.88
3 for $188.88 . . . 8W0584 . . .$188.88/

BURGLAR ALARM BOARD



Neat new closed-circuit alarm board will latch a relay if the alarm circuit is opened. This unit operates on 12-VDC at such a low price, it makes a perfect compact alarm component. With Data. Qty Ltd.
Sh. Wt. 6 oz.. . . . 8K30267 . . . .$2.88
5 for $13.88. . . 8K30267 . . $13.88/5

SPECIAL!

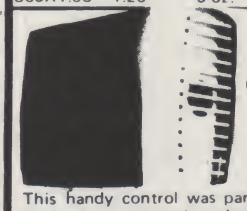
"AA" NiCad 8-PACK

NEW! 8 "AA" cells in handy package, gives 10V Split into single cells for 1.25V ea.
8 oz/pack. . . . 8V20305 . . . $8.00/pack

RECHARGEABLE 1.25V

1.25V per cell. Used, good condition Sizes are AA-oversize, & sub-C (check dimensions).

Size (in).	Amp . . Hr	Sh. Wt.	Order No.
365X1.91	.60	4 oz.	7V70468
865X1.63	1.20	5 oz.	7V70470



REMOTE CONTROL SYSTEM

Ultrasonic

This handy control was part of an Admiral remote control package for color TV. The original functions were On-Off, volume, VHF-UHF, and channel select. Receiver contains 3-relays and one four position stepping relay. Also includes a complete data pkg. Control section operates on 115 VAC. Good for toys, garage door openers, TV, stereo systems or any of those STAR TREK inovations you would like to make on your own. (Energize or de-energize your alarm system remotely. Range 30' Transmitter requiares AA cell (not included). Qty ltd.
Sh. Wt 1 Lb. . . . 8C30372 **$25.00/Set**
3 for $69.88 . . 8C30372 . . . $69.88/3

SPECIAL OFFER - MENTION THIS AND TAKE 10% OFF ANY ORDER OVER $10.00.

16/8 WATT STEREO AMP.

Neat assembled board contains all solid state components. Contains a DARLINGTON drive, push-pull output, all with complementary power tab transistors & mounted to lg. heat sinks. Accepts input from tape decks, magnetic or ceramic phono cartridges, mikes, etc. Requires a 48V xformer & 1 meg volume control. (not supplied) Output 8 into 8 ohms. (supplied with data).
Sh. Wt. 1 Lb. . . . .8Y0513 . . . .$5.78
*Stereo Xformer . . . 8G0530 . . .$2.88
*Stereo Pkg.-16 watts W/xformer & Cont. Sh. Wt. 4 Lbs. .8E0544 . .$13.88

COMPUTER STUFF

TTY . . .	MD33 . . .	ASR . . .	$348.88
TTY . . .	MD33 . . .	KSR . . .	$288.88
TTY . . .	.MD33 . . .	RO . . .	$248.88
TTY . . .	MD35 . . .	ASR . . .	$448.88
TTY . . .	MD35 . . .	KSR . . .	$388.88
DEC	PDP8M.		$1488.88

*IBM 725 I/O—W/Keyboard . . $498.88
Singer MD70 Work Station I/O, Yours for only. $298.88
Singer Pertec 7-Track Key-To-Tape 4311 Com $228.88
Singer Line Printer MD52 . . . . $350.00
*Nova/IBM Desk Top Term. . . $748.88
Nova/IBM Desk Top Terminal (ASC11) Price $888.88
Viatron System 21. . . . . $495.00
*IBM SELECTRIC (BALL) PRINTER

RACK CABINET EQUIPTO

Size 24"x 68" with rails on front & back for mounting equipment on 19" centers. No doors or sides List Price $185.00 NEW SURPLUS! Your cost only $50 each. Qty ltd. Frt Collect
80B2049 . . . . . **$50.00**

TV–GAME BOARD good for 5V, 1A P.S., TV–COMPUTER DISPLAY INTERFACE

NEW game board, just off production run. These boards contain a 5V, 1A power supply (less xformer), a "TV-computer interface "(modulator), plus 16 or 20 "74L series IC's & a handful of other components. Complete with schematic for a TV Tennis/Handball game, etc.
Instructions are included for using the 5V 1A power supply. **TV-Interface**
Sh. Wt 8 oz. . . . . 8T30322 . . . **$6.88**
3 for $17.88 . . . 8T30322 . . . $17.88/3
† TRANSFORMER for power supply above.
Sh. Wt 1 Lb . . . . .8T30339 . . . . $1.00

10M – PERSONAL COMPUTING

Use these short cassettes for only one program per cassette. These 10 minute running time are ideal for all programs – List Price $1.50 each. Yours for only $1.50 for 2. Use in the TRS-80, PET & SWT units. Priced to sell!

Sh. Wt. 6 oz.	9C0043	$1.50/2
8 for $5.00	9C0043	$5.00/8
20 for $10.00	9C0043	$10.00/20

PHONES"....

3-Line, & 11 Line, call directors with rotary dial. Reconditioned, Please state choice!
Sh. Wt. 10 Lbs. .3 Line. 8C0277. $28.88
Sh. Wt. 15 Lbs. .11 Line 8C0550 $49.88
ALSO: TOUCH TONE-PAY STATION TELEPHONES . . .8C30273. . . $69.88

AD/2-WAY LOUDSPEAKER KIT SAVE 65%....

This neat accustic suspension system with 8" woofer, 3 1/2" super horn, Piezo tweeter, Freq. Resp. 25 Hz. To 25 Khz. Walnut vinyl cabinets x 7½"Hg. x 11¼"Dp. Max. power 60 watts, Imp. 9 ohms. Kit includes 2-enclosures, 2-8" woofers, 2-Piezo tweeters, grill cloth, terminals, accoustic dampening, Inst. assembly.
DO-IT-YOURSELF & SAVE! This system listed for $81.00ea.
Sh. Wt. 38Lbs. . .9Y0005. . $68.88/Pr.

POSTAGE: Please add postage, *UPS material is F.O.B. Peabody, Ma.* **No C.O.D.'s please.** *Massachusetts Residents add 5% sales tax.*

PHONE ORDERS WELCOME!
Use your Bank Americard, Master Charge or American Express Credit Card!
$10.00 min. on all charge orders.

B&F ENTERPRISES
Dept. K5
119 Foster Street B4
Peabody, MA. 01960
(617) 531-5774

SAVE WITH SURPLUS **B&F**

FREE JUMBO CATALOG! JAM-PACKED WITH SURPLUS ELECTRONIC PARTS GADGETS, KITS AND MORE! CIRCLE READER SERVICE COUPON!

Reader Service—see page 179

AIM 65 BY ROCKWELL INTERNATIONAL

AIM 65 is fully assembled, tested and warranted. With the addition of a low cost, readily available power supply, it's ready to start working for you.

AIM 65 features on-board thermal printer and alphanumeric display, and a terminal-style keyboard. It has an addressing capability up to 65K bytes, and comes with a user-dedicated 1K or 4K RAM. Two installed 4K ROMS hold a powerful Advanced Interface Monitor program, and three spare sockets are included to expand on-board ROM or PROM up to 20K bytes.

An Application Connector provides for attaching a TTY and one or two audio cassette recorders, and gives external access to the user-dedicated general purpose I/O lines.

Also included as standard are a comprehensive AIM 65 User's Manual, a handy pocket reference card, an R6500 Hardware Manual, an R6500 Programming Manual and an AIM 65 schematic.

AIM 65 is packaged on two compact modules. The circuit module is 12 inches wide and 10 inches long, the keyboard module is 12 inches wide and 4 inches long. They are connected by a detachable cable.

THERMAL PRINTER
Most desired feature on low-cost microcomputer systems . . .
- Wide 20-column printout
- Versatile 5 x 7 dot matrix format
- Complete 64-character ASCII alphanumeric format
- Fast 120 lines per minute
- Quite thermal operation
- Proven reliability

FULL-SIZE ALPHANUMERIC KEYBOARD
Provides compatibility with system terminals . . .
- Standard 54 key, terminal-style layout
- 26 alphabetic characters
- 10 numeric characters
- 22 special characters
- 9 control functions
- 3 user-defined functions

TRUE ALPHANUMERIC DISPLAY
Provides legible and lengthy display . . .
- 20 characters wide
- 16-segment characters
- High contrast monolithic characters
- Complete 64-character ASCII alphanumeric format

PROVEN R6500 MICROCOMPUTER SYSTEM DEVICES
Reliable, high performance NMOS technology . . .
- R6502 Central Processing Unit (CPU), operating at 1 MHz. Has 65K address capability, 13 addressing modes and true index capability. Simple but powerful 56 instructions.
- Read/Write Memory, using R2114 Static RAM devices. Available in 1K byte and 4K byte versions.
- 8K Monitor Program Memory, using R2332 Static ROM devices. Has sockets to accept additional 2332 ROM or 2532 PROM devices, to expand on-board Program memory up to 20K bytes.
- R6532 RAM-Input/Output-Timer (RIOT) combination device. Multipurpose circuit for AIM 65 Monitor functions.
- Two R6522 Versatile Interface Adapter (VIA) devices, which support AIM 65 and user functions. Each VIA has two parallel and one serial 8-bit, bidirectional I/O ports, two 2-bit peripheral handshake control lines and two fully-programmable 16-bit interval timer/event counters.

BUILT-IN EXPANSION CAPABILITY
- 44-Pin Application Connector for peripheral add-ons
- 44-Pin Expansion Connector has full system bus
- Both connectors are KIM-1 compatible

TTY AND AUDIO CASSETTE INTERFACES
Standard interface to low-cost peripherals . . .
- 20 ma. current loop TTY interface
- Interface for two audio cassette recorders
- Two audio cassette formats: ASCII KIM-1 compatible and binary, blocked file assembler compatible

ROM RESIDENT ADVANCED INTERACTIVE MONITOR
Advanced features found only on larger systems . . .
- Monitor-generated prompts
- Single keystroke commands
- Address independent data entry
- Debug aids
- Error messages
- Option and user interface linkage

ADVANCED INTERACTIVE MONITOR COMMANDS
- Major Function Entry
- Instruction Entry and Disassembly
- Display/Alter Registers and Memory
- Manipulate Breakpoints
- Control Instruction/Trace
- Control Peripheral Devices
- Call User-Defined Functions
- Comprehensive Text Editor

LOW COST PLUG-IN ROM OPTIONS
- 4K Assembler—symbolic, two-pass
- 8K BASIC Interpreter

POWER SUPPLY SPECIFICATIONS
- +5 VDC ± 5% regulated @ 2.0 amps (max)
- +24 VDC ±15% unregulated @ 2.5 amps (peak) 0.5 amps average

PRICE: $375.00 (1K RAM)

Plus $4.00 UPS (shipped in U.S. must give ***street*** address), $10 parcel post to APO's, FPO's, Alaska, Hawaii, Canada, $25 air mail to all other countries

We manufacture a complete line of high quality expansion boards. Use reader service card to be added to our mailing list, or U.S. residents send $1.00 (International send $3.00 U.S.) for airmail delivery of our complete catalog.

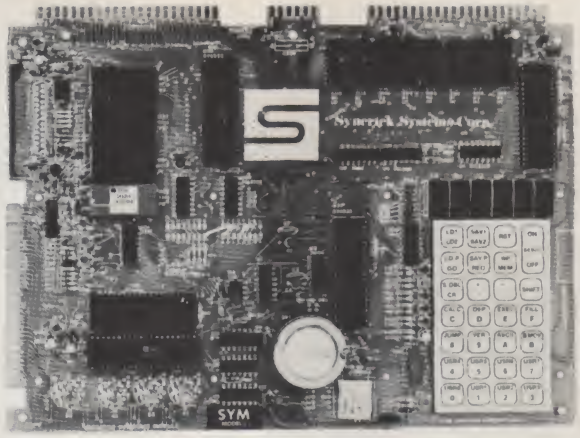
RNB ENTERPRISES
INCORPORATED R20

2967 W. Fairmount Avenue
Phoenix AZ. 85017
(602)265-7564

master charge VISA

SYM-1, 6502-BASED MICROCOMPUTER

- FULLY-ASSEMBLED AND COMPLETELY INTEGRATED SYSTEM that's ready-to-use
- ALL LSI IC'S ARE IN SOCKETS
- 28 DOUBLE-FUNCTION KEYPAD INCLUDING UP TO 24 "SPECIAL" FUNCTIONS
- EASY-TO-VIEW 6-DIGIT HEX LED DISPLAY
- KIM-1* HARDWARE COMPATIBILITY
  The powerful 6502 8-Bit MICROPROCESSOR whose advanced architectural features have made it one of the largest selling "micros" on the market today.
- THREE ON-BOARD PROGRAMMABLE INTERVAL TIMERS available to the user, expandable to five on-board.
- 4K BYTE ROM RESIDENT MONITOR and Operating Programs.
- Single 5 Volt power supply is all that is required.
- 1K BYTES OF 2114 STATIC RAM onboard with sockets provided for immediate expansion to 4K bytes onboard, with total memory expansion to 65, 536 bytes.
- USER PROM/ROM: The system is equipped with 3 PROM/ROM expansion sockets for 2316/2332 ROMs or 2716 EPROMs
- ENHANCED SOFTWARE with simplified user interface
- STANDARD INTERFACES INCLUDE:
  —Audio Cassette Recorder Interface with Remote Control (Two modes: 135 Baud KIM-1* compatible, Hi-Speed 1500 Baud)
  —Full duplex 20mA Teletype Interface
  —System Expansion Bus Interface
  —TV Controller Board Interface
  —CRT Compatible Interface (RS-232)
- APPLICATION PORT: 15 Bi-directional TTL Lines for user applications with expansion capability for added lines
- EXPANSION PORT FOR ADD-ON MODULES (51 I/O Lines included in the basic system)
- SEPARATE POWER SUPPLY connector for easy disconnect of the d-c power
- AUDIBLE RESPONSE KEYPAD



Synertek has enhanced KIM-1* software as well as the hardware. The software has simplified the user interface. The basic SYM-1 system is programmed in machine language. Monitor status is easily accessible, and the monitor gives the keypad user the same full functional capability of the TTY user. The SYM-1 has everything the KIM-1* has to offer, plus so much more that we cannot begin to tell you here. So, if you want to know more, the SYM-1 User Manual is available, separately.

SYM-1 Complete w/manuals **$249.00**
SYM-1 User Manual Only **7.00**
SYM-1 Expansion **75.00**
Expansion includes 3K of 2114 RAM chips and 1-6522 I/O chip.

SYM-1 Manuals: The well organized documentation package is complete and easy-to-understand.

SYM-1 CAN GROW AS YOU GROW. It's the system to BUILD-ON.
Expansion features that are available:

BAS-1 8K Basic ROM (Microsoft Basic) **129.00**
Kim-2 (Complete terminal less monitor) **349.00**

QUALITY EXPANSION BOARDS DESIGNED SPECIFICALLY FOR KIM-1, SYM-1 & AIM 65

These boards are set up for use with a regulated power supply such as the one below, but, provisions have been made so that you can aaa onboard regulators for use with an unregulated power supply. But, because of unreliability, we do not recommend the use of onboard regulators. All I.C.'s are socketed for ease of maintenance. *All boards carry full 90-day warranty.*

All products that we manufacture are designed to meet or exceed industrial standards. All components are first qualtiy and meet full manufacturer's specifications. All this and an extended burn-in is done to reduce the normal percentage of field failures by up to 75%. To you, this means the chance of inconvenience and lost time due to a failure is very rare; but, if it should happen, we guarantee a turn-around time of less than forty-eight hours for repair.

Our money back guarantee: If, for any reason you wish to return any board that you have purchased directly from us within ten (10) days after receipt, complete, in original condition, and in original shipping carton; we will give you a complete credit or refund less a $10.00 restocking charge per board.

VAK-1 8-SLOT MOTHERBOARD

This motherboard uses the KIM-4* bus structure. It provides eight (8) expansion board sockets with rigid card cage. Separate jacks for audio cassette, TTY and power supply are provided. Fully buffered bus.

VAK-1 Motherboard **$129.00**

VAK-2/4 16K STATIC RAM BOARD

This board using 2114 RAMs is configured in two (2) separately addressable 8K blocks with individual write-protect switches.

VAK-2 16K RAM Board with only 8K of RAM (½ populated) **$239.00**
VAK-3 Complete set of chips to expand above board to 16K **$175.00**
VAK-4 Fully populated 16K RAM **$379.00**

VAK-5 2708 EPROM PROGRAMMER

This board requires a +5 VDC and ±12 VDC, but has a DC to DC multiplyer so there is no need for an additional power supply. All software is resident in on-board ROM, and has a zero-insertion socket.

VAK-5 2708 EPROM Programmer **$269.00**

VAK-6 EPROM BOARD

This board will hold 8K of 2708 or 2758, or 16K of 2716 or 2516 EPROMs. *EPROMs not included.*

VAK-6 EPROM Board **$129.00**

VAK-7 COMPLETE FLOPPY-DISK SYSTEM (May '79)

VAK-8 PROTYPING BOARD

This board allows you to create your own interfaces to plug into the motherboard. Etched circuitry is provided for regulators, address and data bus drivers; with a large area for either wire-wrapped or soldered IC circuitry.

VAK-8 Protyping Board **$49.00**

POWER SUPPLIES

ALL POWER SUPPLIES are totally enclosed with grounded enclosures for safety, AC power cord, and carry a full 2-year warranty.

FULL SYSTEM POWER SUPPLY

This power supply will handle a microcomputer and up to 65K of our VAK-4 RAM. ADDITIONAL FEATURES ARE: Over voltage Protection on 5 volts, fused, AC on/off switch. Equivalent to units selling for $225.00 or more.

Provides +5 VDC @ 10 Amps & ±12 VDC @ 1 Amp
VAK-EPS Power Supply **$125.00**

KIM-1* Custom P.S. provides 5 VDC @ 1.2 Amps and +12 VDC @ .1 Amps
KCP-1 Power Supply **$41.50**

SYM-1 Custom P.S. provides 5 VDC @ 1.4 Amps
VCP-1 Power Supply **$41.50**

*KIM is a product of MOS Technology

RNB ENTERPRISES
INCORPORATED
R20
2967 W. Fairmount Avenue
Phoenix AZ. 85017
(602)265-7564

master charge VISA

WAMECO

W22

THE COMPLETE PC BOARD HOUSE
EVERYTHING FOR THE S-100 BUSS

* **FPB-1** FRONT PANEL BOARD
  Hex Displays, IMSAI Replaceable $54.95
* **FDC-1** FLOPPY DISC CONTROLLER BOARD
  Controls up to 8 Discs $45.00
* **MEM-1A** 8K BYTE 2102 RAM Board $31.95
* **MEM-2** 16K BYTE 2114 RAM Board $31.95
* **CPU-1** 8080A CPU Board
  With Vector Interrupt $31.95
* **EPM-1** 4K BYTE 1702A EPROM $29.95
* **EPM-2** 16K or 32K BYTE EPROM
  2708 or 2176 interchangeable $30.00
* **QMB-9** 9 SLOT MOTHER BOARD
  Terminated $35.00
* **QMB-12** 12 SLOT MOTHER BOARD
  Terminated $40.00
* **RTC** REALTIME CLOCK
  Programmable Interrupts $27.95

FUTURE PRODUCTS: 80 CHARACTER VIDEO BOARD,
IO BOARD WITH CASSETTE INTERFACE.

DEALER INQUIRIES INVITED, UNIVERSITY DISCOUNTS AVAILABLE
AT YOUR LOCAL DEALER

wmc inc. WAMECO INC. 111 GLENN WAY #8, BELMONT, CA 94002 (415) 592-6141

CALIFORNIA COMPUTER SYSTEMS

16K RAM BOARD. Fully buffered addressable in 4K blocks. IEEE standard for bank addressing 2114's
PCBD $26.95
Kit 450 NSEC $259.95

PT-1 PROTO BOARD. Over 2,600 holes 4" regulators. All S-100 buss functions labeled, gold fingers.
PCBD $26.95

PT-2 PROTO BOARD. Similar to PT-1 except set-up to handle solder tail sockets.
PCBD $26.95

FORMERLY CYBERCOM/SOLID STATE MUSIC.

PB-1 2708 & 2716 Programming Board with provisions for 4K or 8K EPROM. No external supplies require textool sockets. Kit $124.95

CB-1 8080 Processor Board. 2K of PROM 256 BYTE RAM power on/rest Vector Jump Parallel port with status Kit .....$119.00 PCBD $30.95

MB-6B Basic 8KX8 ram uses 2102 type rams, S-100 buss. Kit 450 NSEC .....$139.95 PCBD $26.95

MB-7 16KX8, Static RAM uses μP410 Protection, fully buffered Kit $299.95

MB-8A 2708 EROM Board. S-100. 8K8X or 16Kx8 kit without PROMS $75.00 PCBD $28.95

MB-9 4KX8 RAM/PROM Board uses 2112 RAMS or 82S129 PROM kit without RAMS or PROMS $72.00

IO-2 S-100 8 bit parallel /IO port, ⅔ of boards is for kludging. Kit .....$46.00 PCBD $26.95

IO-4 Two serial I/O ports with full handshaking 20/60 ma current loop: Two parallel I/O ports.
Kit .....$130.00 PCBD $26.95

VB-1B 64 x 16 video board, upper lower case Greek, composite and parallel video with software, S-100.
Kit .....$125.00 PCBD $26.95

Altair Compatible Mother Board, 11 x 11½ x ⅛". Board only .....$39.95. With 15 connectors $94.95

Extended Board full size. Board only .....$ 9.49
With connector $13.45

SP-1 Synthesizer Board S-100
PCBD .....$42.95 KIT $135.95

wmc inc. WAMECO INC.

FDC-1 FLOPPY CONTROLLER BOARD will drive shugart, pertek, remic 5" & 8" drives up to 8 drives, on board PROM with power boot up, will operate with CPM (not included).
PCBD $42.95

FPB-1 Front Panel. IMSAI size, hex displays. Byte, or instruction single step.
PCBD $47.50

MEM-1 8KX8 fully buffered, S-100, uses 2102 type rams. PCBD $25.95

QM-12 MOTHER BOARD, 13 slot, terminated, S-100 board only $34.95

CPU-1 8080A Processor board S-100 with 8 level vector interrupt PCBD $26.95

RTC-1 Realtime clock board. Two independent interrupts. Software programmable. PCBD $23.95

EPM-1 1702A 4K Eprom card PCBD $25.95

EPM-2 2708/2716 16K/32K
EPROM CARD PCBD $25.95

QM-9 MOTHER BOARD, Short Version of QM-12. 9 Slots PCBD $30.95

MEM-2 16K x 8 Fully Buffered
2114 Board PCBD $26.95

8080A	$9.95	5101-8P	$ 8.40
8212	2.49	2114 (450 NS) low pwr	7.25
8214	4.49	2114 (250 NS) low pwr	7.99
8224	3.49	2102A-2L	1.50
2708	9.49	2102A-4L	1.20
5101-1P	6.90	4116	8/89.95

MIKOS

(415) 592-1800
P. O. Box 424 • San Carlos, California 94070
Please send for IC, Xistor and Computer parts list M39

AUG SPECIAL SALE
ON PREPAID ORDERS
(charge cards not included on this offer)

VB-1B WITH MIKOS #6 KIT . . $84.95
8KX8 RAM Fully buffered 450 NSEC. 2.5 amp typical assembled parts may be unmarked or house numbered. $99.99

MIKOS PARTS ASSORTMENT
WITH WAMECO AND CYBERCOM PCBDS

MEM-2 with MIKOS #7 16K ram with L2114 450 NSEC $249.95
MEM-2 with MIKOS #13 16K ram with L2114 250 NSEC $279.95
MEM-1 with MIKOS #1 450 NSEC 8K RAM $119.95
CPU-1 with MIKOS #2 8080A CPU $94.95
MEM-1 with MIKOS #3 250 NSEC 8K RAM $144.95
QM-12 with MIKOS #4 13 slot mother board $89.95
RTC-1 with MIKOS #5 real time clock $54.95
VB-1B with MIKOS #6 video board less molex connectors $99.95
EMP-1 with MIKOS #10 4K 1702 less EPROMS $49.95
EPM-2 with MIKOS #11 16-32K EPROMS less EPROMS $59.95
QM-9 with MIKOS #12 9 slot mother board $79.95
FPB-1 with MIKOS #14 all parts for front panel $134.95

MIKOS PARTS ASSORTMENTS ARE ALL FACTORY PRIME PARTS. KITS INCLUDE ALL PARTS LISTED AS REQUIRED FOR THE COMPLETE KIT LESS PARTS LISTED ALL SOCKETS INCLUDED.

VISA or MASTERCHARGE. Send account number, interbank number, expiration date and sign your order. Approx. postage will be added. Check or money order will be sent post paid in U.S. If you are not a regular customer, please use charge, cashier's check or postal money order. Otherwise there will be a two-week delay for checks to clear. Calif. residents add 6% tax. Money back 30 day guarantee. We cannot accept returned IC's that have been soldered to. Prices subject to change without notice. **$10 minimum order. $1.50 service charge on orders less than $10.00.**

TRS-80 E.S. SERIAL I/O

• Can input into basic • Can use LLIST and LPRINT to output, or output continuously • RS-232 compatible • Can be used with or without the expansion bus • On board switch selectable baud rates of 110, 150, 300, 600, 1200, 2400, parity or no parity odd or even, 5 to 8 data bits, and 1 or 2 stop bits. D.T.R. line • Requires +5, -12 VDC • Board only $19.95 Part No. 8010, with parts $59.95 Part No. 8010A, assembled $79.95 Part No. 8010 C. No connectors provided, see below.

EIA/RS-232 connector Part No. DB25P $6.00, with 9', 8 conductor cable $10.95 Part No. DB25P9.

3' ribbon cable with attached connectors to fit TRS-80 and our serial board $19.95 Part No. 3CAB40.

MODEM✲

• Type 103 • Full or half duplex • Works up to 300 baud • Originate or Answer • No coils, only low cost components • TTL input and output-serial • Connect 8 Ω speaker and crystal mic. directly to board • Uses XR FSK demodulator • Requires +5 volts • Board only $7.60 Part No. 109, with parts $27.50 Part No. 109A

DISKETTES

BOX OF 10

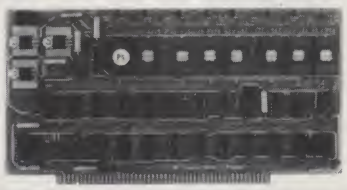
5" $29.95
8" $39.95

APPLE II✲ SERIAL I/O INTERFACE

Baud rate is continuously adjustable from 0 to 30,000 • Plugs into any peripheral connector • Low current drain. RS-232 input and output • On board switch selectable 5 to 8 data bits, 1 or 2 stop bits, and parity or no parity either odd or even • Jumper selectable address • SOFTWARE • Input and Output routine from monitor or BASIC to teletype or other serial printer • Program for using an Apple II for a video or an intelligent terminal. Also can output in correspondence code to interface with some selectrics. • Also watches DTR • Board only $15.00 Part No. 2, with parts $42.00 Part No. 2A, assembled $62.00 Part No. 2C

8K EPROM PIICEON

Saves programs on PROM permanently (until erased via UV light) up to 8K bytes. Programs may be directly run from the program saver such as fixed routines or assemblers. • S-100 bus compatible • Room for 8K bytes of EPROM non-volatile memory (2708's). • On-board PROM programming • Address relocation of each 4K of memory to any 4K boundary within 64K • Power on jump and reset jump option for "turnkey" systems and computers without a front panel • Program saver software available • Solder mask both sides • Full silkscreen for easy assembly. Program saver software in 1 2708 EPROM $25. Bare board $35 including custom coil, board with parts but no EPROMS $139, with 4 EPROMS $179, with 8 EPROMS $219.



T.V. TYPEWRITER

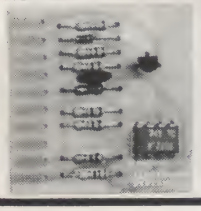
• Stand alone TVT • 32 char/line, 16 lines, modifications for 64 char/line included • Parallel ASCII (TTL) input • Video output • 1K on board memory • Output for computer controlled curser • Auto scroll • Non-destructive curser • Curser inputs: up, down, left, right, home, EOL, EOS • Scroll up, down • Requires +5 volts at 1.5 amps, and -12 volts at 30 mA • All 7400, TTL chips • Char. gen. 2513 • Upper case only • Board only $39.00 Part No. 106, with parts $145.00 Part No. 106A

TAPE ✲ INTERFACE

• Play and record Kansas City Standard tapes • Converts a low cost tape recorder to a digital recorder • Works up to 1200 baud • Digital in and out are TTL-serial • Output of board connects to mic. in of recorder • Earphone of recorder connects to input on board • No coils • Requires +5 volts, low power drain • Board only $7.60 Part No. 111, with parts $27.50 Part No. 111A

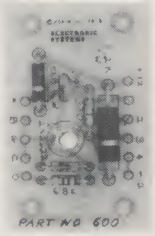
RS-232/ TTL✲ INTERFACE

• Converts TTL to RS-232, and converts RS-232 to TTL • Two separate circuits • Requires -12 and +12 volts • All connections go to a 10 pin gold plated edge connector • Board only $4.50 Part No. 232, with parts $7.00 Part No. 232A 10 Pin edge connector $3.00 Part No. 10P



RS-232/ TTY✲ INTERFACE

• Converts RS-232 to 20mA current loop, and 20mA current loop to RS-232 • Two separate circuits • Requires +12 and -12 volts • Board only $4.50 Part No. 600, with parts $7.00 Part No. 600A

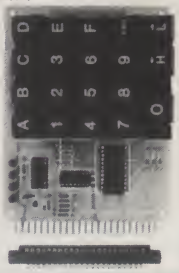


UART & BAUD RATE GENERATOR✲

• Converts serial to parallel and parallel to serial • Low cost on board baud rate generator • Baud rates: 110, 150, 300, 600, 1200, and 2400 • Low power drain +5 volts and -12 volts required • TTL compatible • All characters contain a start bit, 5 to 8 data bits, 1 or 2 stop bits, and either odd or even parity. • All connections go to a 44 pin gold plated edge connector • Board only $12.00 Part No. 101, with parts $35.00 Part No. 101A, 44 pin edge connector $4.00 Part No. 44P

HEX ENCODED KEYBOARD E.S.

This HEX keyboard has 19 keys, 16 encoded with 3 user definable. The encoded TTL outputs, 8-4-2-1 and STROBE are debounced and available in true and complement form. Four onboard LEDs indicate the HEX code generated for each key depression. The board requires a single +5 volt supply. Board only $15.00 Part No. HEX-3, with parts $49.95 Part No. HEX-3A. 44 pin edge connector $4.00 Part No. 44P.



WAMECO PRODUCTS WITH ELECTRONIC SYSTEMS PARTS

FDC-1 FLOPPY CONTROLLER BOARD will drive shugart, pertek, remex 5" & 8" drives up to 8 drives, on board PROM with power boot up, will operate with CPM (not included). PCBD $42.95

FPB-1 Front Panel. (Finally) IMSAI size hex displays. Byte or instruction single step. PCBD $42.95

MEM-1A 8Kx8 fully buffered, S-100, uses 2102 type RAMS. PCBD ..... $24.95, $168 Kit

QMB-12 MOTHER BOARD, 13 slot, terminated, S-100 board only ..... $34.95 $89.95 Kit

CPU-1 8080A Processor board S-100 with 8 level vector interrupt PCBD ... $25.95 $89.95 Kit

RTC-1 Realtime clock board. Two independent interrupts. Software programmable. PCBD ..... $25.95, $60.95 Kit

EPM-1 1702A 4K EPROM card PCBD ..... $25.95 $49.95 with parts less EPROMS

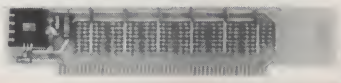
EPM-2 2708/2716 16K/32K EPROM card PCBD ..... $24.95 $49.95 with parts less EPROMS

QMB-9 MOTHER BOARD. Short Version of QMB-12. 9 Slots PCBD ..... $30.95 $67.95 Kit

MEM-2 16Kx8 Fully Buffered 2114 Board PCBD ..... $25.95, $269.95 Kit

S-100 BUS ✲ ACTIVE TERMINATOR

Board only $14.95 Part No. 900, with parts $24.95 Part No. 900A



DC POWER SUPPLY✲

• Board supplies a regulated +5 volts at 3 amps., +12, -12, and -5 volts at 1 amp. • Power required is 8 volts AC at 3 amps., and 24 volts AC C.T. at 1.5 amps. • Board only $12.50 Part No. 6085, with parts excluding transformers $42.50 Part No. 6085A

To Order: Mention part number, description, and price. In USA, shipping paid for orders accompanied by check, money order, or Master Charge, BankAmericard, or VISA number, expiration date and signature. Shipping charges added to C.O.D. orders. California residents add 6.5% for tax. Outside USA add 10% for air mail postage and handling, no C.O.D.'s. Checks and money orders must be payable in US dollars. Parts kits include sockets for all ICs, components, and circuit board. Documentation is included with all products. Prices are in US dollars. No open accounts. To eliminate tariff in Canada boxes are marked "Computer Parts." Dealer inquiries invited. 24 Hour Order Line: (408) 226-4064

✲ Circuits designed by John Bell

For free catalog including parts lists and schematics, send a self-addressed stamped envelope.

ELECTRONIC SYSTEMS Dept. KB, P. O. Box 21638, San Jose, CA USA 95151

JADE Computer Products

Rockwell AIM-65: The Head-Start In Microcomputers

A KIM-1 compatible machine with on-board printer and a real keyboard!

$375.00 w/1K RAM
$450.00 w/4K RAM

4K assembler/editor in ROM:	$ 80.00
8K BASIC in ROM:	$100.00
Power supply:	$ 59.95
Case for AIM-65:	$ 49.95

Special Package Price: $599.00
AIM-65 (4K), Power Supply, Case, and 8K BASIC ROM

THE EXIDY SORCERER

Flexibilty is the key. The Sorcerer Computer gives you the flexibility of using ready-to-run, pre-packaged programs or doing your own thing and personalizing the programs for yourself. Which ever you choose, the Sorcerer is the personal computer that speaks your language.

The Sorcerer also provides full graphics capabilties. Each character, formed by an 8 x 8 dot cell, can be programmed as a graphic symbol set. High resolution (512 x 240 addressable points) gives a total of 122,880 locations for super animation and extremely tight plotting curves. The alphanumeric set gives 64 x 30 characters on the video screen

With 16K of memory $1150.00

TRS-80*APPLE*SORCERER*TRS-80*APPLE*SORCERER

JADE MEMORY EXPANSION KITS For TRS—80, Apple, & Exidy 4116's

Everything a person needs to add 16K of memory. Chips come neatly packaged with easy to follow directions. In minutes your machine is ready for games and more advanced software.

$82.00

THE SYM-1 $245

6502 — based single board computer with keyboard/display, KIM-1 hardware compatible, complete documentation.

SYM—1 CASE $39.95

THE KIM 1 $179

KIM-1 Module monitor, programs stored in 2048 ROM Bytes. User Manual, Wall size schematic, Hardware manual, Programming manual, Programmers reference card,and Keyboard display.

SD SYSTEMS Z-80 STARTER KIT

Based on the powerful Z80 CPU, this kit is an ideal introduction to microprocessors. It has an on-board keyboard and display, plus cassette tape interface and expansion provisions for two S-100 connectors. This "Do-it-all" Board will also program the 2716 2K EPROM.

Kit	$249.95
Assembled and Tested	$399.95

JADE PROTO BOARD

Includes gold plated fingers, S-100 size, holds 72-16 pin dips, accomodates all 8 thru 40 pin dip packages.

$19.95

JADE VIDEO INTERFACE

S-100 Compatible Serial Interface with Sockets Included.

Kit	$117.95
Assembled & Tested	$159.95
Bare Board w/manual	$ 35.00

MEM-2 16 K Static RAM Board

Kit- (450ns)	$250.00
Kit- (250ns)	$285.00
Assembled- (450ns)	$325.00
Assembled- (250ns)	$350.00

DYNAMIC RAM BOARDS EXPANDABLE TO 64K

32K VERSION • KITS

Uses 4115 (8Kx1, 250ns) Dynamic RAM's, can be expanded in 8K increments up to 32K:

8K $159.00	24K $249.00
16K $199.00	32K $299.00

4115 SALE
8 for $39.95

64K VERSION • KITS

Uses 4116 (16Kx1, 200ns) Dynamic RAM's, can be expanded in 16K increments up to 64K:

16K $249.00	48K $469.00
32K $369.00	64K $569.00

THE PIGGY MAINFRAME

THE PIGGY IS HERE!

This sleak new mainframe is neatly trimmed to hold six S-100 boards, two mini-floppy drives, and is available in five colors. Power requirements: 115/220 VAC, 50/60 HZ. Weight: 27 lbs. (with drives). Dimensions: 21.375" Wide X 8.4" High X 15.875" Deep. Power Supply: 8 volts at 18 Amps unregulated, + 16 volts at 3 amps unregulated, - 16 volts at 3 amps unregulated, + 5 volts at 3 amps regulated, + 12 volts at 3 amps regulated.

THE PIGGY (Without Drives).... $475.00

FLOPPY DISK INTERFACE

JADE FLOPPY DISK (Tarbell board)

Kit	$195.00
Assembled & Tested	$250.00

S.D. Computer Products VERSA-FLOPPY

Kit	$159.95
Assembled & Tested	$239.00

JADE PARALLEL/SERIAL INTERFACE

S-100 compatible, 2 serial I/O ports, 1 parallel I/O.

Kit JG-P/S	$124.95
Assembled & Tested JG-P/SA	$179.95
Bare Board w/Manual	$ 30.00

★ STATIC RAM SPECIALS ★

2114's, low power (1024x4)

	1-15	16-99	100 +
450ns	8.00	6.95	5.50
300ns	9.00	8.00	6.50

TMS4044/MM5257, low power

450ns	8.00	7.50	6.50
300ns	9.95	8.75	8.00

4200A (4K x1, 200ns)

9.95	8.50	8.00

410D (4K x 1, 200 ns)

8.25	7.00	6.75

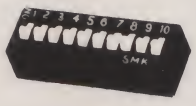
LEEDEX MONITOR

- 12" Black and White
- 12MHZ Bandwidth
- Handsome Plastic Case

$139.00

DIP SWITCHES

Part No.	positions	1-9
SWD-103	3	$1.18
SWD-104	4	$1.20
SWD-105	5	$1.24
SWD-106	6	$1.28
SWD-107	7	$1.30
SWD-108	8	$1.34
SWD-109	9	$1.36
SWD-110	10	$1.38



Solid State Music's I/O 4

2- Serial & 2- Parallel I/O Ports. S-100 with full handshaking.

KIT	$149.95
Assembled	$199.95
Bare Board	$29.95

SD SYSTEMS SBC-100

An S-100 single board computer. Z-80 CPU with 1024 bytes of RAM, 8 to 32K bytes of PROM, Serial I/O port.

Kit	$239.95
Assembled	$369.95

TARBELL Cassette Interface

Plugs into your IMSAI or ALTAIR, 4 extra status lines, 37 page manual included, 4 extra control lines.

Kit	$99.95
Assembled	$175.00
Bare Board	$40.00
Manual	$8.00

VECTOR PLUG BOARDS

8800V
Universal/Microcomputer/Processor Plugboard S-100 Bus. Complete With Heat Sink & Hardware.
5.3" x 10" x 1/16"
$19.95

8801-1
Same as 8800V Except Plain, Less Power Buses & Heat Sink.
$15.95

P Pattern Plugboards For i.C.'s Epoxy Glass 1/18" 44 Pin Connector Space .156
3662 6.5" x 4.5" $7.65
3662-2 9.6" x 4.5" ..... $11.45.

Hi-Density Dual-In-Line Plugboard For Wire Wrap With Power & Grd. Bus Epoxy Glass 1/16" 44 Pin Con Spaced .156
3682 9.6" x 4.5" $10.97
3682-2 6.5" x 4.5 ..... $9.81

Gen Purpose D.I.P. Boards With Bus Pattern For Solder Or Wire Wrap. Epoxy Glass 1/16" 44 Pin Con. Space .156
3677 9.6" x 4.5" $10.90
3677-2 6.5" x 4.5 ..... $9.74

3690-12
Card Extender
Card Extender Has 100 Contacts 50 Per Side ON .125 centers. Attached Connector is Compatible With S-100 Bus Systems
$25.83
3690 6.5" 22/4 Pin .158 Centers Extenders. $13.17

STATIC RAM BOARDS

JADE 8K

Kits:	450ns	$125.95
	250ns	$149.75
Assembled & Tested:		
	450ns	$139.75
	250ns	$169.75
Bare Board:		$ 25.00

16K — Uses 2114's (low power)
Assembled & Tested:
RAM 16 (250ns) $375.00
RAM 16B (450ns) $325.00

16K with memory management
Assembled & Tested:
RAM 65 (250ns) $390.00
RAM 65B (450ns) $350.00

32K Static
Assembled & Tested:
250ns $795.00
450ns $725.00
250ns Kit $575.00

PLACE ORDERS TOLL FREE: 800/421-5809 Continental U.S. 800/262-1710 Inside California

THE BIG Z
THE NEW Z-80
CPU BOARD FROM JADE

Features Include: ■ S-100 Compatible, available in 2MHz or 4MHz versions. ■ On-board 2708, 2716, 2516, or 2532 EPROM can be addressed on any 1K, 2K, or 4K boundary, with power-on jump to EPROM. ■ On-board EPROM may be used in SHADOW mode, allowing full 64K RAM to be used. ■ Automatic MWRITE generation if front panel is not used. ■ On-board USART for synchronous or asynchronous RS232 operation (on-board baud rate generator). ■ Reverse-channel capability on USART allows use with buffered peripherals or devices with "not-ready" signal.

2MHz-	Kit: CPU-30200K, 2 lbs	$149.95
	Assembled and Tested: CPU-30200A, 2 lbs	$199.95
4 MHz-	Kit: CPU-30201K, 2 lbs	$159.95
	Assembled and Tested CPU-30201A, 2 lbs	$209.95

JADE'S DOUBLE DENSITY

DD™

KIT: $249.00
Assmb. & Tstd: $299.00

- Single or Double Density Recording
- Full Size or Mini Floppy
- CP/M Compatible in either density
- Programmed Data Transfer, no DMA
- Controls up to 8 drives
- IBM format in either density
- Software Selectable Density

■ This controler utilizes the proven reliability of the IBM standard format as well as the lastest phase-locked-loop for data separation ■ All clocks are generated from an on-board crystal oscillator ■ Right precompensation is used to enhance data recovery reliability in the double density mode ■ Density selection is entirely transparent to the user ■ Single and double density diskettes can be mixed on the same system.

MICROPROCESSORS	
F8	$16.95
Z8u (2MHz)	$10.95
Z80A (4MHz)	$14.95
CDP1802CD	$19.95
6502	$11.95
6800	$9.75
6802	$14.00
8008-1	$15.95
8035	$24.00
8035-8	$24.00
8080-A	$10.00
8085	$23.00
TMS9900TL	$49.95
8080A SUPPORT DEVICES	
8212	$2.90
8214	$4.65
8216	$2.75
8224 (2MHz)	$4.30
8224-4 (4MHz)	$9.95
8226	$2.75
8228	$6.40
8238	$6.40
8243	$8.00
8251	$7.50
8253	$20.00
8255	$6.40
8257	$18.00
8259	$18.00
8275	$51.20
8279	$17.70
USRT	
S2350	$10.95
UARTS	
AY5-1013A	$5.25
AY5-1014A	$8.25
TR1602B	$5.25
TMS6011	$5.95
IM6403	$9.00
BAUD RATE GENERATORS	
MC14411	$10.00
14411 Crystal	$4.95
6800 PRODUCT	
6821P	$5.25
6828P	$9.50
6834P	$16.95
6850P	$4.80
6852P	$5.25
6860P	$9.25
6862P	$12.00
6875L	$7.30
6880P	$2.50
CHARACTER GENERATORS	
2513 Upper (1-12 5)	$6.75
2513 Lower (1-12 5)	$6.75
2513 Upper (5 volt)	$9.75
2513 Lower (5 volt)	$10.95
MCM6571 up scan	$10.95
MCM6571A down scan	$10.95
PROMS	
1702A	$5.00
2708	$12.95
2716 (5 12)	$49.00
2716 (5v)	$49.00
2758 (5v)	$30.00
DYNAMIC RAMS	
416D/4116 (200ns)	$12.50
2104/4096	$4.00
2107B-4	$3.95
TMS4027/4096	$4.00

STATIC RAMS	1—15	16—100
21L02 (450ns)	$1.50	$1.20
21L02 (250ns)	$1.75	$1.50
2101-1	$2.95	$2.60
2111-1	$3.25	$3.00
2112-1	$2.95	$2.65

FLOPPY DISK CONTROLLERS	
1771801	$39.95
1791	$49.95
KEYBOARD CHIPS	
AY5-2376	$13.75
AY5-3600	$13.75
MM5740	$18.00

POWER SUPPLIES

PSD-249A: For a Single 5 1/4" Disk Drive. By Power-One or Alpha Power: +5V at .7A, +/- 12V at 1.1A $52.00

PSD-205A: For Single 8" Disk Drive. By Power-One. +5V at 1A, -5V at .5A, +24V at 1.5A $89.95

PSD-206A: For Two 8" Disk Drives. By Power-One or Alpha Power. +5V at 2.5A, -5V at .5A, +/-24V at 3A $125.00

Rockwell: Aim-65 Power Supply
PSX-030A $59.95

KIM-1 or SYM-1 Power Supply:
PSX-020A $59.95

★ DISK DRIVES ★

B51 5¼" $295.00
by Micro Peripherals, Inc. Operates in either single density (125KB, unformatted) or double density (250KB, unformatted) modes, up to 40 tracks, with a track-to-track access time of only 5 ms.

SA801R $575.00
by Shugart Single-sided 8" floppy disk drive.

FD8-100 $395.00
GSI/Siemens. Runs cooler and quieter than 801 (8")

SA400 $325.00
Single density 5¼, 35-Track drive. Cabinet and power supply available

1791 BO1
Dual Density Controller Chip
$49.95

Vista V80 Mini Disk SYSTEM FOR TRS—80
$395.00

Includes disk drive, power supply, regulator board, and compact case. The V-80 offers 23% more storage capacity. Simply take it out of the box, plug in the cable, and it's ready to run. Requires 16K, Level II, expansion interface.

Signal Cable $24.95

JADE CABLE ASSEMBLIES

Mini-Disk Cable Kit: 5 1/4" interface to 2 Shugart or compatible drives. Cable is 5' long with 34 pin edge connectors WCA-3431K $34.95

8" Disk Cable Kit No. 1: 34 pin assembly WCA-5031K $38.45

8" Disk Cable Kit No. 2: 50 pin assembly (great for Tarbell disk controller) WCA-5032K $38.45

Signal Cables: 6 feet long, 34 pin edge connectors at each end $24.95
WCA-3421A

JADE ISO—BUS MOTHERBOARDS

Comes in either 6, 12, or 18 slot sizes. These boards with a special ground plane assures a silent operation

JADE 6 Slot	
Kit	$49.95
Assembled	$59.95
Bare Board	$24.95
JADE 12 Slot	
Kit	$89.95
Assembled	$99.95
Bare Board	$39.95
JADE 18 Slot	
Kit	$129.95
Assembled	$149.95
Bare Board	$59.95

- Two Drives Siemens/ GSI 8" Floppy
- Power Supply for Above
- Jade Double Density Board (KIT)
- CP/M Operating System with Basic E
- Package of 10 Blank 8" Diskettes (Double Density)
- Includes Interface Cables

Price if Purchased Separately $1544.95
Jade Special Package Deal
$1225.00

JADE Computer Products

✓J6

4901 W. ROSECRANS AVENUE
Department "F" 3
HAWTHORNE, CALIFORNIA 90250
U.S.A.

Telephone
(213) 679-3313
(800) 421-5809 Continental U.S.
(800) 262-1710 Inside California

Cash, checks, money orders, and credit cards accepted. Minimum order: $10.00, California residents add 6% sales tax. Minimum shipping and handling charge: $2.50. Discounts available at OEM quantities.

WRITE FOR OUR FREE CATALOG
All prices subject to change without notice.

3M or VERBATIM FLOPPY DISKS

5¼ in. Minidiskettes
Soft sector, 10 sector, or 16 sector
$4.40 each or
Box of ten for $37.50
8 in. Standard Floppy Disks
$4.75 each or
Box of ten for $35.00

Transistor Checker

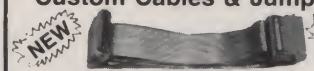
— Completely Assembled —
— Battery Operated —

The ASI Transistor Checker is capable of checking a wide range of transistor types, either "in circuit" or out of circuit. To operate, simply plug the transistor to be checked into the front panel socket, or connect it with the alligator clip test leads provided. The unit safely and automatically identifies low, medium and high-power PNP and NPN transistors. Size: 3¾" x 6¼" x 2"
"C" cell battery not included.

NEW!

Trans-Check $29.95 ea.

Custom Cables & Jumpers



DB 25 Series Cables

Part No.	Cable Length	Connectors	Price
DB25P-4-P	4 Ft.	2-DP25P	$15.95 ea.
DB25P-4-S	4 Ft.	1-DP25P/1-25S	$16.95 ea.
DB25S-4-S	4 ft.	2-DP25S	$17.95 ea.

Dip Jumpers

DJ14-1	1 ft.	1-14 Pin	$1.59 ea.
DJ16-1	1 ft.	1-16 Pin	1.79 ea.
DJ24-1	1 ft.	1-24 Pin	2.79 ea.
DJ14-1-14	1 ft.	2-14 Pin	2.79 ea.
DJ16-1-16	1 ft.	2-16 Pin	3.19 ea.
DJ24-1-24	1 ft.	2-24 Pin	4.95 ea.

For Custom Cables & Jumpers, See JAMECO 1979 Catalog for Pricing

CONNECTORS
25 Pin-D Subminiature

DB25P (as pictured)	PLUG (Meets RS232)	$2.95
DB25S	SOCKET (Meets RS232)	$3.50
DB51226-1	Cable Cover for DB25P or DB25S	$1.75

PRINTED CIRCUIT EDGE-CARD

.156 Spacing-Tin-Double Read-Out — Bifuracted Contacts — Fits .054 to .070 P.C. Cards

15/30	PINS (Solder Eyelet)	$1.95
18/36	PINS (Solder Eyelet)	$2.49
22/44	PINS (Solder Eyelet)	$2.95
50/100 (.100 Spacing)	PINS (Wire Wrap)	$6.95
50/100 (.125 Spacing)	PINS (Wire Wrap) R681-1	$6.95

4-Digit Clock Kit

* Bright .357" ht. red display
* Sequential flashing colon
* 12 or 24 hour operation
* Extruded aluminum case (black)
* Pressure switches for hours, minutes & hold functions
* Includes all components, case and wall transformer
* Size: 3¼ x 1¾ x 1¼

JE730 $14.95

Jumbo 6-Digit Clock Kit

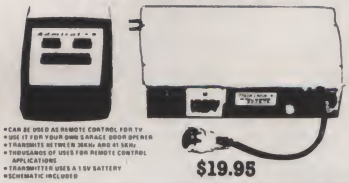
* Four .630"ht. and two .300"ht. common anode displays
* Uses MM5314 clock chip
* Switches for hours, minutes and hold functions
* Hours easily viewable to 30 feet
* Simulated walnut case
* 115 VAC operation
* 12 or 24 hour operation
* Includes all components, case and wall transformer
* Size: 6¾ x 3⅛ x 1¾

JE747 $29.95

JE701
6-Digit Clock Kit $19.95

- Bright .300 ht. comm. cathode display
- Uses MM5314 clock chip
- Switches for hours, minutes and hold modes
- Hrs. easily viewable to 20 ft.
- Simulated walnut case
- 115 VAC operation
- 12 or 24 hr. operation
- Incl. all components, case & wall transformer
- Size: 6¾" x 3-1/8" x 1¾"

REMOTE CONTROL TRANSMITTER & RECEIVER



- CAN BE USED AS REMOTE CONTROL FOR TV
- USE IT FOR YOUR OWN GARAGE DOOR OPENER
- TRANSMITS BETWEEN 300Hz AND 41.5KHz
- THOUSANDS OF USES FOR REMOTE CONTROL APPLICATIONS
- TRANSMITTER USES A 1.5V BATTERY
- SCHEMATIC INCLUDED

$19.95

Digital Stopwatch Kit

* Use Intersil 7205 Chip
* Plated thru double-sided P.C. Board
* LED display (red)
* Times to 59 min. 59.59 sec. with auto reset
* Quartz crystal controlled
* Three stopwatches in one: single event, split (cummulative) & taylor (sequential timing)
* Uses 3 penlite batteries
* Size: 4.5" x 2.15" x .90"

JE900 $39.95

MICROPROCESSOR COMPONENTS

8080A/8080A SUPPORT DEVICES

8080A	CPU	$ 9.95
8212	8-Bit Input/Output	3.25
8214	Priority Interrupt Control	5.95
8216	Bi-Directional Bus Driver	3.49
8224	Clock Generator/Driver	3.95
8226	Bus Driver	3.49
8228	System Controller/Bus Driver	5.95
8238	System Controller	5.95
8251	Prog. Comm. 1/0 (USART)	7.95
8253	Prog. Interval Timer	14.95
8255	Prog. Periph. 1/0 (PPI)	9.95
8257	Prog. DMA Control	19.95
8259	Prog. Interrupt Control	19.95

6800/6800 SUPPORT DEVICES

MC6800	MPU	$14.95
MC6802CP	MPU with Clock and Ram	24.95
MC6810API	128X8 Static Ram	5.95
MC6821	Periph. Inter. Adapt (MC6820)	7.49
MC6828	Priority Interrupt Controller	12.95
MC6830L8	1024X8 Bit ROM (MC68A30-8)	14.95
MC6850	Asynchronous Comm. Adapter	7.95
MC6852	Synchronous Serial Data Adapt.	9.95
MC6860	0-600 bps Digital MODEM	12.95
MC6862	2400 bps Modulator	14.95
MC6880A	Quad 3-State Bus. Trans. (MC8T26)	2.25

MICROPROCESSOR CHIPS—MISCELLANEOUS

Z80(780C)	CPU	$19.95
Z80A(780-1)	CPU	24.95
CDP1802	CPU	19.95
2650	MPU	19.95
6502	CPU	11.95
8035	8-Bit MPU w/clock, RAM, 1/0 lines	19.95
P8085	CPU	19.95
TMS9900JL	16-Bit MPU w/hardware, multiply & divide	49.95

SHIFT REGISTERS

MM500H	Dual 25 Bit Dynamic	$.50
MM503H	Dual 50 Bit Dynamic	.50
MM504H	Dual 16 Bit Static	.50
MM506H	Dual 100 Bit Static	.50
MM510H	Dual 64 Bit Accumulator	.50
MM5016H	500/512 Bit Dynamic	.89
2504T	1024 Dynamic	3.95
2518	Hex 32 Bit Static	4.95
2522	Dual 132 Bit Static	2.95
2524	512 Static	.99
2525	1024 Dynamic	2.95
2527	Dual 256 Bit Static	2.95
2528	Dual 250 Static	4.00
2529	Dual 240 Bit Static	4.00
2532	Quad 80 Bit Static	2.95
2533	1024 Static	2.95
3341	Fifo	6.95
74LS670	4X4 Register File (TriState)	2.49

UART'S

A-Y-5-1013	30K BAUD	5.95

MICROPROCESSOR MANUALS

M-Z80	User Manual	$7.50
M-CDP1802	User Manual	7.50
M-2650	User Manual	5.00

ROM'S

2513(2140)	Character Generator(upper case)	$9.95
2513(3021)	Character Generator(lower case)	9.95
2516	Character Generator	10.95
MM5230N	2048-Bit Read Only Memory	1.95

RAM'S

1101	256X1	Static	$1.49
1103	1024X1	Dynamic	.99
2101(8101)	256X4	Static	3.95
2102	1024X1	Static	1.75
21L02	1024X1	Static	1.95
2111(8111)	256X4	Static	3.95
2112	256X4	Static MOS	4.95
2114	1024X4	Static 450ns	9.95
2114L	1024X4	Static 450ns low power	10.95
2114-3	1024X4	Static 300ns	10.95
2114L-3	1024X4	Static 300ns low power	11.95
5101	256X4	Static	7.95
5280/2107	4096X1	Dynamic	4.95
7489	16X4	Static	1.75
74S200	256X1	Static Tristate	4.95
93421	256X1	Static	2.95
UPD414 (MK4027)	4K	Dynamic 16 pin	4.95
UPD416 (MK4116)	16K	Dynamic 16 pin	9.95
TMS4044-45NL	4K	Static	14.95
TMS4045	1024X4	Static	14.95
2117	16,384X1	Dynamic 350ns (house marked)	9.95
MM5262	2KX1	Dynamic	4/1.00

PROM'S

1702A	2048	FAMOS	$5.95
2716/INTEL	16K*	EPROM	59.95
TMS2516	16K*	EPROM	49.95
(2716)	*Requires single +5V power supply		
TMS2532	4KX8	EPROM	89.95
2708	8K	EPROM	10.95
2716 T.I	16K**	EPROM	29.95
	**Requires 3 voltages, —5V, +5V, +12V		
5203	2048	FAMOS	14.95
6301-1(7611)	1024	Tristate Bipolar	3.49
6330-1(7602)	256	Open C Bipolar	2.95
82S23	32X8	Open Collector	3.95
82S115	4096	Bipolar	19.95
82S123	32X8	Tristate	3.95
74186	512	TTL Open Collector	9.95
74188	256	TTL Open Collector	3.95
74S287	1024	Static	2.95

CSC CONTINENTAL SPECIALTIES

Proto Board 203

A total, ready-to-use power breadboard prototest device with a built-in regulated, short proof power supply. Just plug in and start building! 2 extra floating 5-way binding posts for external signals. Self-contained with power switch indicator lamp and power fuse. 24-14 pin DIP capacity. Attractive two-tone quality case. All metal construction. 9¾"L x 6¾"W x 2¾"H 5 lbs.

PB 203 **$75.00**

Model Number	L x W x H (Inches)	Price
PB-6	6.0 x 4.5 x 1.4	$15.95
PB-100	6.0 x 4.5 x 1.4	$19.95
PB-101	6.0 x 4.5 x 1.4	$22.95

Proto Board 203A

All the features of the PB-203 plus additional power supply flexibility, provides 1% Regulated 5VDC supply (same specifications as PB-203). Regulated separate +15VDC and —15 VDC 0.5A supplies, each with internally and independently adjustable output voltage. Ripple and noise of + and —15V supplies. 10mV at 0.25A

PB 203A **$124.95**

Model Number	L x W x H (Inches)	Price
PB-102	7.0 x 4.5 x 1.4	$26.95
PB-103	9.0 x 6.0 x 1.4	$44.95
PB-104	9.8 x 8.0 x 1.4	$54.95

THE SINCLAIR PDM35

DC Volts (4 ranges)
Range 1mV to 1000V
Accuracy of reading 1.0%± 1 count.
Note: 10MΩ input impedance.
AC Volts (40 Hz-5 kHz)
Range IV to 500 V
Accuracy of reading 1.0%± 2 counts.
DC Current (6 ranges)
Range 1 nA to 200 mA
Accuracy of reading 1.0%± 1 count.
Note: Max. resolution 0.1 nA
Resistance (5 ranges)
Range: 1Ω to 20 MΩ.
Accuracy of reading: 1.5%± 1 count.
Also provides 5 junction-test ranges.
Dimensions: 6 in x 3 in x 1½ in.
Weight: 6½ oz.
Power Supply: 9 V battery or Sinclair AC adapter (Battery not incl.)
Sockets: Standard 4mm for resilient plugs.

Options: AC adapter for 117 V 60 Hz power. De-luxe padded carrying wallet.

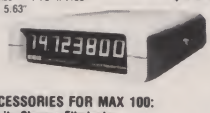
PDM35: Digital Multimeter . . . $59.95 (completely assembled)
PDM-AC: 117V AC Adapter . . . 6.95
PDM-DP: Deluxe padded carrying case. . . 6.95

100 MHz 8-Digit Counter

CSC CONTINENTAL SPECIALTIES CORPORATION

- 20 Hz-100 MHz Range
- 6" LED Display
- Crystal-controlled timebase
- Fully Automatic
- Portable — completely self-contained
- Size — 1.75" x 7.38" x 5.63"
- Four power sources, i.e batteries, 110 or 220V with charger 12V with auto lighter adapter and external 7.2-10V power supply

MAX-100 $134.95



ACCESSORIES FOR MAX 100:
Mobile Charger Eliminator use power from car battery — Model 100 — CLA $3.95
Charger/Eliminator use 110 V AC — Model 100 — CAI $9.95

REGULATED POWER SUPPLY NEW!

JE200 5V-1AMP POWER SUPPLY

- *Uses LM309K
- *Heat sink provided
- *PC Board construction
- *Provides a solid 1 amp @ 5 volts
- *Can supply up to ±5V, ±9V and ±12V with JE205 Adapter
- *Includes components, hardware & instructions
- *Size: 3½"x5"x2"H

JE200 $14.95

JE205 ADAPTER BOARD — Adapts to JE200 — ±5V, ±9V and ±12V

- •DC/DC converter w/ +5V input
- •Toriodal hi-speed switching XMFR
- •Short circ. protection
- •PC Brd. construction
- •Piggy-back to JE200 board
- •Size: 3½"x2"x 9/16"H

JE205 $12.95

$10.00 Min. Order — U.S. Funds Only
Calif. Residents Add 6% Sales Tax
Postage — Add 5% plus $1 Insurance (if desired)

Spec Sheets — 25¢
1979 Catalog Available — Send 41¢ stamp

FREE A 1979 CATALOG

Jameco ELECTRONICS

PHONE ORDERS WELCOME (415) 592-8097

MAIL ORDER ELECTRONICS — WORLDWIDE
1021 HOWARD AVENUE, SAN CARLOS, CA 94070
ADVERTISED PRICES GOOD THRU AUGUST

The Incredible "Pennywhistle 103"

$139.95 Kit Only

The Pennywhistle 103 is capable of recording data to and from audio tape without critical speed requirements for the recorder and it is able to communicate directly with another modern and terminal for telephone "hammng" and communications. In addition, it is free of critical adjustments and is built with non-precision, readily available parts.

Data Transmission Method . . . . . Frequency-Shift Keying, full-duplex (half-duplex selectable).
Maximum Data Rate . . . . . 300 Baud.
Data Format . . . . . Asynchronous Serial (return to mark level required between each character).
Receive Channel Frequencies . . . 2025 Hz for space, 2225 Hz for mark.
Transmit Channel Frequencies . . Switch selectable: Low (normal) = 1070 space, 1270 mark; High = 025 space, 2225 mark.
Receive Sensitivity . . . . . —46 dbm accoustically coupled
Transmit Level . . . . . —15 dbm nominal. Adjustable from —8 dbm to —20 dbm.
Receive Frequency Tolerance . . . Frequency reference automatically adjusts to allow for operation between 1800 Hz and 2400 Hz.
Digital Data Interface . . . . . EIA RS-232C or 20 mA current loop (receiver is optonsolated and non-polar).
Power Requirements . . . . . 120 VAC, single phase, 10 Watts.
Physical . . . . . All components mount on a single 5" by 9" printed circuit board. All components included.

Requires a VOM, Audio Oscillator, Frequency Counter and/or Oscilloscope to align.

TRS-80 16K Conversion Kit

Expand your 4K TRS-80 System to 16K. Kit comes complete with:

* 8 each UPD416-1 (16K Dynamic Rams) 250NS
* Documentation for conversion

TRS-16K $75.00

COMPUTER CASSETTES

- 6 EACH 15 MINUTE HIGH QUALITY C-15 CASSETTES
- PLASTIC CASE INCLUDED 12 CASSETTE CAPACITY
- ADDITIONAL CASSETTES AVAILABLE #C-15-$2.95 ea

CAS-6 $14.95
(Case and 6 Cassettes)

SUP 'R' MOD II
UHF Channel 33 TV Interface Unit

Wide Band B/W or Color System

★ Converts TV to Video Display for home computers, CCTV camera, Apple II, works with Cromeco Dazzler, SOL-20, IRS-80, Challenger, etc.

MOD II is pretuned to Channel 33 (UHF).

★ Includes coaxial cable and antenna transformer.

MOD II $29.95 Kit

Function Generator Kit

- Provides 3 basic waveforms: sine, triangle & square wave
- Frequency range from 1 Hz to 100K Hz
- Output amplitude from 0-volts to over 6 volts (peak to peak)
- Uses a 12V supply or a ±6V split supply
- Incl. chip, P.C. board, components and instructions.

JE2206B $19.95

IDEAL FOR TRS 80 CASSETTE CONTROLLER

"Plug/Jack interface to any computer system requiring remote control of cassette functions"

The CC100 controls cassette motor functions, monitors tape location with its internal speaker and requires no power. Eliminates the plugging and unplugging of cables during computer loading operation from cassette.

#CC-100 $29.50

63-Key Unencoded Keyboard

This is a 63-key, terminal keyboard newly manufactured by a large computer manufacturer. It is unencoded with SPST keys, unattached to any kind of PC board. A very solid molded plastic 13 x 4" base suits most application. IN STOCK **$29.95/each**

Hexadecimal Unencoded Keypad

19-key pad includes 1-10 keys, ABCDEF and 2 optional keys and a shift key. **$10.95/each**

7400 TTL


		SN7470N	.29		
		SN7472N	.29		
SN7400N	.18	SN7473N	.35	SN74160N	.89
SN7401N	.18	SN7474N	.35	SN74161N	.89
SN7402N	.18	SN7475N	.49	SN74162N	1.95
SN7403N	.18	SN7476N	.35	SN74163N	.89
SN7404N	.18	SN7479N	5.00	SN74164N	.89
SN7405N	.20	SN7480N	.50	SN74165N	.89
SN7406N	.29	SN7482N	.99	SN74166N	1.25
SN7407N	.29	SN7483N	.59	SN74167N	1.95
SN7408N	.20	SN7485N	.79	SN74170N	1.59
SN7409N	.20	SN7486N	.35	SN74172N	8.00
SN7410N	.18	SN7489N	1.75	SN74173N	1.25
SN7411N	.25	SN7490N	.45	SN74174N	.89
SN7412N	.25	SN7491N	.59	SN74175N	.79
SN7413N	.40	SN7492N	.43	SN74176N	.79
SN7414N	.70	SN7493N	.43	SN74177N	.79
SN7416N	.25	SN7494N	.65	SN74179N	1.95
SN7417N	.25	SN7495N	.65	SN74180N	.79
SN7420N	.20	SN7496N	.65	SN74181N	1.95
SN7421N	.29	SN7497N	3.00	SN74182N	.79
SN7422N	.39	SN74100N	.89	SN74184N	1.95
SN7423N	.25	SN74107N	.35	SN74185N	1.95
SN7425N	.29	SN74109N	.59	SN74186N	9.95
SN7426N	.29	SN74116N	1.95	SN74188N	3.95
SN7427N	.25	SN74121N	.35	SN74190N	1.25
SN7429N	.39	SN74122N	.39	SN74191N	1.25
SN7430N	.20	SN74123N	.49	SN74192N	.79
SN7432N	.25	SN74125N	.49	SN74193N	.79
SN7437N	.25	SN74126N	.49	SN74194N	.89
SN7438N	.25	SN74132N	.75	SN74195N	.69
SN7439N	.25	SN74136N	.75	SN74196N	.89
SN7440N	.20	SN74141N	.79	SN74197N	.89
SN7441N	.89	SN74142N	2.95	SN74198N	1.49
SN7442N	.49	SN74143N	2.95	SN74199N	1.49
SN7443N	.75	SN74144N	2.95	SN74S200	4.95
SN7444N	.75	SN74145N	.79	SN74251N	1.79
SN7445N	.75	SN74147N	1.95	SN74279N	.79
SN7446N	.69	SN74148N	1.29	SN74283N	2.25
SN7447N	.59	SN74150N	.89	SN74284N	3.95
SN7448N	.79	SN74151N	.59	SN74285N	3.95
SN7450N	.20	SN74152N	.59	SN74365N	.69
SN7451N	.20	SN74153N	.59	SN74366N	.89
SN7453N	.20	SN74154N	.99	SN74367N	.69
SN7454N	.20	SN74155N	.79	SN74368N	.69
SN7459A	.25	SN74156N	.79	SN74390N	1.95
SN7460N	.20	SN74157N	.65	SN74393N	1.95

C/MOS

CD4000	.23			CD4070	.55
CD4001	.23			CD4071	.23
CD4002	.23	CD4028	.89	CD4072	.49
CD4006	1.19	CD4029	1.19	CD4078	1.39
CD4007	.25	CD4030	.49	CD4081	.23
CD4009	.49	CD4035	.99	CD4082	.23
CD4010	.49	CD4040	1.19	CD4093	.99
CD4011	.23	CD4041	1.25	CD4098	2.49
CD4012	.25	CD4042	.99	MC14409	14.95
CD4013	.39	CD4043	.89	MC14410	14.95
CD4014	1.39	CD4044	.89	MC14411	14.95
CD4015	1.19	CD4046	1.79	MC14419	4.95
CD4016	.49	CD4047	2.50	MC14433	19.95
CD4017	1.19	CD4048	1.35	MC14506	.75
CD4018	.99	CD4049	.49	MC14507	.99
CD4019	.49	CD4050	.49	MC14562	14.50
CD4020	1.19	CD4051	1.19	MC14583	3.50
CD4021	1.39	CD4053	1.19	CD4508	3.95
CD4022	1.19	CD4056	2.95	CD4510	1.39
CD4023	.23	CD4059	9.95	CD4511	1.29
CD4024	.79	CD4060	1.49	CD4515	2.95
CD4025	.23	CD4066	.79	CD4518	1.29
CD4026	2.25	CD4068	.39	CD4520	1.29
CD4027	.69	CD4069	.45	CD4566	2.25

74C00

74C00	.39			74C163	2.49
74C02	.39			74C164	2.49
74C04	.39	74C85	2.49	74C173	2.60
74C08	.49	74C90	1.95	74C192	2.49
74C10	.39	74C93	1.95	74C193	2.49
74C14	1.95	74C95	1.95	74C195	2.49
74C20	.39	74C107	1.25	74C922	5.95
74C30	.39	74C151	2.90	74C923	6.25
74C42	1.95	74C154	3.00	74C925	8.95
74C48	2.49	74C157	2.15	74C926	8.95
74C73	.89	74C160	2.49	80C95	1.50
74C74	.89	74C161	2.49	80C97	1.50

LINEAR

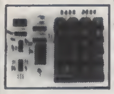
78MG	1.75			LM710N	.79
LM106H	.99			LM711N	.39
LM300H	.80	LM340K-18	1.35	LM723N/H	.55
LM301CN/H	.35	LM340K-24	1.35	LM733N	1.00
LM302H	.75	LM340T-5	1.25	LM739N	1.19
LM304H	1.00	LM340T-6	1.25	LM741CN/H	.35
LM305H	.60	LM340T-8	1.25	LM741-14N	.39
LM307CN/H	.35	LM340T-12	1.25	LM747N/H	.79
LM308CN/H	1.00	LM340T-15	1.25	LM748N/H	.39
LM309H	1.10	LM340T-18	1.25	LM1310N	2.95
LM309K	1.25	LM340T-24	1.25	LM1458CN/H	.59
LM310CN	1.15	LM358N	1.00	MC1488N	1.39
LM311N/H	.90	LM370N	1.95	MC1489N	1.39
LM312H	1.95	LM373N	3.25	LM1496N	.95
LM317K	6.50	LM377N	4.00	LM1556V	1.75
LM318CN/H	1.50	LM380N	1.25	MC1741SCP	3.00
LM319N	1.30	LM380CN	.99	LM2111N	1.95
LM320K-5	1.35	LM381N	1.79	LM2901N	2.95
LM320K-5.2	1.35	LM382N	1.79	LM3053N	1.50
LM320K-12	1.35	NE501N	8.00	LM3065N	1.49
LM320K-15	1.35	NE510A	8.00	LM3900N(3401)	.49
LM320K-18	1.35	NE529A	4.95	LM3905N	.89
LM320K-24	1.35	NE531H/V	3.95	LM3909N	1.25
LM320T-5	1.25	NE536T	6.00	MC5558V	.59
LM320T-5.2	1.25	NE540L	6.00	8038B	4.95
LM320T-8	1.25	NE544N	4.95	LM75450N	.49
LM320T-12	1.25	NE550N	1.30	75451CN	.39
LM320T-15	1.25	NE555V	.39	75452CN	.39
LM320T-18	1.25	NE556N	.99	75453CN	.39
LM320T-24	1.25	NE560B	5.00	75454CN	.39
LM323K-5	5.95	NE561B	5.00	75491CN	.79
LM324N	1.80	NE562B	5.00	75492CN	.89
LM339N	.99	NE565N/H	1.25	75493N	.89
LM340K-5	1.35	NE566CN	1.75	75494CN	.89
LM340K-6	1.35	NE567V/H	.99	RC4136	1.25
LM340K-8	1.35	NE570N	4.95	RC4151	2.85
LM340K-12	1.35	LM703CN/H	.69	RC4194	5.95
LM340K-15	1.35	LM709N/H	.29	RC4195	4.49

74LS00TTL

74LS00	.29			74LS138	.89
74LS01	.29	74LS47	.89	74LS139	.89
74LS02	.29	74LS51	.29	74LS151	.89
74LS03	.29	74LS54	.29	74LS155	.89
74LS04	.35	74LS55	.29	74LS157	.89
74LS05	.35	74LS73	.45	74LS160	1.15
74LS08	.29	74LS74	.45	74LS161	1.15
74LS09	.35	74LS75	.59	74LS162	1.15
74LS10	.29	74LS76	.45	74LS163	1.15
74LS11	.75	74LS78	.49	74LS164	1.25
74LS13	.59	74LS83	.89	74LS175	.99
74LS14	1.25	74LS85	1.25	74LS181	2.49
74LS15	.35	74LS86	.45	74LS190	1.15
74LS20	.29	74LS90	.59	74LS191	1.15
74LS21	.35	74LS92	.75	74LS192	1.15
74LS22	.35	74LS93	.75	74LS193	1.15
74LS26	.35	74LS95	.99	74LS194	1.15
74LS27	.35	74LS96	1.15	74LS195	1.15
74LS28	.35	74LS107	.45	74LS253	.99
74LS30	.29	74LS109	.45	74LS257	.89
74LS32	.35	74LS112	.45	74LS258	1.75
74LS37	.45	74LS123	1.25	74LS260	.69
74LS40	.35	74LS125	.89	74LS279	.75
74LS42	.89	74LS132	.99	74LS367	.75
		74LS136	.49	74LS368	.75
				74LS670	2.49

EXCITING NEW KITS

NEW JE600 HEXADECIMAL ENCODER KIT



FEATURES:
- Full 8 bit latched output for microprocessor use
- 3 User Define keys with one being bistable operation
- Debounce circuit provided for all 19 keys
- LED readout to verify entries
- Easy interfacing with standard 16 pin 1C connector
- Only +5VDC required for operations

FULL 8 BIT LATCHED OUTPUT—19 KEYBOARD

The JE600 Encoder Keyboard provides two separate hexadecimal digits produced from sequential key entries to allow direct programming for 8 bit microprocessor or 8 bit memory circuits. Three (3) additional keys are provided for user operations with one having a bistable output available. The outputs are latched and monitored with LED readouts. Also included is a key entry strobe.

JE600 .... $59.95

Digital Thermometer Kit

NEW

- Dual sensors—switching control for in-door/outdoor or dual monitoring
- Continuous LED .8" ht. display
- Range: -40°F to 199°F / -40°C to 100°C
- Accuracy: ±1° nominal
- Set for Fahrenheit or Celsius reading
- Sim. walnut case - AC wall adapter incl.
- Size: 3-1/4"H x 6-5/8"W x 1-3/8"D

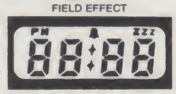
JE300 .... $39.95

DISCRETE LEDS

.200" dia.				.125" dia.		
XC556R	red	5/$1		XC209R	red	5/$1
XC556G	green	4/$1		XC209G	green	4/$1
XC556Y	yellow	4/$1		XC209Y	yellow	4/$1
XC556C	clear	4/$1				
.200" dia.				.185" dia.		
XC22R	red	5/$1		XC526R	red	5/$1
XC22G	green	4/$1		XC526G	green	4/$1
XC22Y	yellow	4/$1		XC526Y	yellow	4/$1
.170" dia.				XC526C	clear	4/$1
MV10B	red	4/$1		.190" dia.		
.085" dia.				XC111R	red	5/$1
MV50	red	6/$1		XC111G	green	4/$1
INFRA-RED LED 1/4"x1/4"x1/16" flat		5/$1		XC111Y	yellow	4/$1
				XC111C	clear	4/$1

TIMEX T1001 LIQUID CRYSTAL DISPLAY CLASS II

FIELD EFFECT



4 DIGIT – .5" CHARACTERS
THREE ENUNCIATORS
2.00" X 1.20" PACKAGE
INCLUDES CONNECTOR

T1001-Transmissive $7.95
T1001A-Reflective 8.25

DISPLAY LEDS

TYPE	POLARITY	HT	PRICE	TYPE	POLARITY	HT	PRICE
MAN 1	Common Anode-red	.270	2.95	MAN 6730	Common Anode-red ± 1	.560	.99
MAN 2	5 x 7 Dot Matrix-red	.300	4.95	MAN 8740	Common Cathode-red-D.D.	.560	.99
MAN 3	Common Cathode-red	.125	.25	MAN 6750	Common Cathode-red ± 1	.560	.99
MAN 4	Common Cathode-red	.187	1.95	MAN 8760	Common Anode-red	.560	.99
MAN 7G	Common Anode-green	.300	1.25	MAN 6780	Common Cathode-red	.560	.99
MAN 7Y	Common Anode-yellow	.300	.99	DL701	Common Anode-red ± 1	.300	.99
MAN 72	Common Anode-red	.300	.99	DL704	Common Cathode-red	.300	.99
MAN 74	Common Cathode-red	.300	1.25	DL707	Common Anode-red	.300	.99
MAN 82	Common Anode-yellow	.300	.99	DL728	Common Cathode-red	.500	1.49
MAN 84	Common Cathode-yellow	.300	.99	DL741	Common Anode-red	.600	1.25
MAN 3620	Common Anode-orange	.300	.99	DL746	Common Anode-red ± 1	.830	1.49
MAN 3630	Common Anode-orange ± 1	.300	.99	DL747	Common Anode-red	.600	1.49
MAN 3640	Common Cathode-orange	.300	.99	DL749	Common Cathode-red ± 1	.630	1.49
MAN 4610	Common Anode-orange	.300	.99	DL750	Common Cathode-red	.600	1.49
MAN 4640	Common Cathode-orange	.400	.99	DL33B	Common Cathode-red	.110	.35
MAN 4710	Common Anode-red	.400	.99	FND70	Common Cathode	.250	.69
MAN 4730	Common Anode-red ± 1	.400	.99	FND358	Common Cathode ± 1	.357	.99
MAN 4740	Common Cathode-red	.400	.99	FND359	Common Cathode	.357	.75
MAN 4810	Common Anode-yellow	.400	.99	FND503	Common Cathode(FND500)	.500	.99
MAN 4840	Common Cathode-yellow	.400	.99	FND507	Common Anode (FND510)	.500	.99
MAN 6610	Common Anode-orange-D.D.	.560	.99	5082-7730	Common Anode-red	.300	1.30
MAN 6630	Common Anode-orange ± 1	.560	.99	HDSP-3400	Common Anode-red	.800	2.10
MAN 6640	Common Cathode-orange-D.D.	.560	.99	HDSP-3403	Common Cathode red	.800	2.10
MAN 6650	Common Cathode-orange ± 1	.560	.99	5082-7300	4 x 7 sgl. Digit-RHDP	.600	19.95
MAN 6660	Common Anode-orange	.560	.99	5082-7302	4 x 7 Sgl. Digit-LHDP	.600	19.95
MAN 6680	Common Cathode-orange	.560	.99	5082-7304	Overrange character (±1)	.600	15.00
MAN 8710	Common Anode-red-D.D.	.560	.99	5082-7340	4 x 7 Sgl. Digit-Hexadecimal	.600	22.50

RCA LINEAR

CA3013T	2.15	CA3082N	2.00
CA2023T	2.56	CA3083N	1.60
CA3035T	2.48	CA3086N	.85
CA3039T	1.35	CA3089N	3.75
CA3046N	1.30	CA3130T	1.39
CA3059N	3.25	CA3140T	1.25
CA3060N	3.25	CA3160T	1.25
CA3080T	.85	CA3401N	.49
CA3081N	2.00	CA3600N	3.50

CALCULATOR CHIPS/DRIVERS

MM5725	$2.95
MM5738	2.95
DM8864	2.00
DM8865	1.00
DM8887	.75
DM8889	.75
9374 7 seg. C.A. LED driver	1.50

CLOCK CHIPS

MM5309	$4.95
MM5311	4.95
MM5312	4.95
MM5314	4.95
MM5318	6.95
MM5318	9.95
MM5369	2.95
MM5387/1998A	4.95
MM5841	9.95

MOTOROLA

MC1408L7	$4.95
MC1408L8	5.75
MC1439L	2.95
MC3022P	2.95
MC3061P	3.50
MC4016(74416)	7.50
MC4024P	3.95
MC4040P	6.95
MC4044P	4.50

IC SOLDERTAIL — LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100		1-24	25-49	50-100
8 pin LP	.$17	.18	.15	22 pin LP	$ .37	.36	.35
14 pin LP	.20	.19	.18	24 pin LP	.38	.37	.36
16 pin LP	.22	.21	.20	28 pin LP	.45	.44	.43
18 pin LP	.29	.28	.27	36 pin LP	.60	.59	.58
20 pin LP	.34	.32	.30	40 pin LP	.63	.62	.81

SOLDERTAIL STANDARD (TIN)

	1-24	25-49	50-100		1-24	25-49	50-100
14 pin ST	$.27	.25	.24	28 pin ST	$ .99	.90	.81
16 pin ST	.30	.27	.25	36 pin ST	1.39	1.26	1.15
18 pin ST	.35	.32	.30	40 pin ST	1.59	1.45	1.30
24 pin ST	.49	.45	.42				

SOLDERTAIL STANDARD (GOLD)

	1-24	25-49	50-100		1-24	25-49	50-100
8 pin SG	$.30	.27	.24	24 pin SG	$ .70	.63	.57
14 pin SG	.35	.32	.29	28 pin SG	1.10	1.00	.90
18 pin SG	.38	.35	.32	36 pin SG	1.65	1.40	1.26
18 pin SG	.52	.47	.43	40 pin SG	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

	1-24	25-49	50-100		1-24	25-49	50-100
8 pin WW	$.39	.38	.31	22 pin WW	$ .95	.85	.75
10 pin WW	.45	.41	.37	24 pin WW	1.05	.95	.85
14 pin WW	.39	.38	.37	28 pin WW	1.40	1.25	1.10
16 pin WW	.43	.42	.41	36 pin WW	1.59	1.45	1.30
18 pin WW	.75	.68	.62	40 pin WW	1.75	1.55	1.40

1/4 WATT RESISTOR ASSORTMENTS – 5%

		10 OHM	12 OHM	15 OHM	18 OHM	22 OHM		
ASST. 1	5 ea	27 OHM	33 OHM	39 OHM	47 OHM	56 OHM	50 PCS	$1.75
		68 OHM	82 OHM	100 OHM	120 OHM	150 OHM		
ASST. 2	5 ea	180 OHM	220 OHM	270 OHM	330 OHM	390 OHM	50 PCS	1.75
		470 OHM	560 OHM	680 OHM	820 OHM	1K		
ASST. 3	5 ea	1.2K	1.5K	1.8K	2.2K	2.7K	50 PCS	1.75
		3.3K	3.9K	4.7K	5.6K	6.8K		
ASST. 4	5 ea	8.2K	10K	12K	15K	18K	50 PCS	1.75
		22K	27K	33K	39K	47K		
ASST. 5	5 ea.	56K	68K	82K	100K	120K	50 PCS	1.75
		150K	180K	220K	270K	330K		
ASST. 6	5 ea	390K	470K	560K	680K	820K	50 PCS	1.75
		1M	1.2M	1.5M	1.8M	2.2M		
ASST. 7	5 ea	2.7M	3.3M	3.9M	4.7M	5.6M	50 PCS	1.75

ASST. 8R Includes Resistor Assortments 1-7 (350 PCS.) **$9.95 ea.**

$10.00 Min. Order – U.S. Funds Only
Calif. Residents Add 6% Sales Tax
Postage – Add 5% plus $1 Insurance (if desired)

Spec Sheets – 25¢
1979 Catalog Available – Send 41¢ stamp

FREE A 1979 CATALOG

Jameco ELECTRONICS

PHONE ORDERS WELCOME (415) 592-8097

MAIL ORDER ELECTRONICS – WORLDWIDE
1021 HOWARD AVENUE, SAN CARLOS, CA 94070
ADVERTISED PRICES GOOD THRU AUGUST

✓ J1

TELEPHONE/KEYBOARD CHIPS

AY-5-9100	Push Button Telephone Dialler	$14.95
AY-5-9200	Repertory Dialler	14.95
AY-5-9500	CMOS Clock Generator	4.95
AY-5-2376	Keyboard Encoder (88 keys)	14.95
HD0165	Keyboard Encoder (16 keys)	7.95
74C922	Keyboard Encoder (16 keys)	5.95

ICM CHIPS

ICM7045	CMOS Precision Timer	24.95
ICM7205	CMOS LED Stopwatch/Timer	19.95
ICM7207	Oscillator Controller	7.50
ICM7208	Seven Decade Counter	19.95
ICM7209	Clock Generator	6.95

NMOS READ ONLY MEMORIES

MCM6571	128 X 9 X 7 ASCII Shifted with Greek	13.50
MCM6574	128 X 9 X 7 Math Symbol & Pictures	13.50
MCM6575	128 X 9 X 7 Alphanumeric Control Character Generator	13.50

MISCELLANEOUS

TL074CN	Quad Low Noise bi-fet Op Amp	2.49
TL494CN	Switching Regulator	4.49
TL496CP	Single Switching Regulator	1.75
11C90	Divide 10/11 Prescaler	19.95
95H90	Hi-Speed Divide 10/11 Prescaler	11.95
4N33	Photo-Darlington Opto-Isolator	3.95
MK50240	Top Octave Freq. Generator	17.50
DS0026CH	5MHz 2-phase MOS clock driver	3.75
TIL308	.27" red num. display w/integ. logic chip	10.50
MM5320	TV Camera Sync. Generator	14.95
MM5330	4½ Digit DPM Logic Block (Special)	3.95
LD110/111	3½ Digit A/D Converter Set	25.00/set

LITRONIX ISO-LIT 1

Photo Transistor Opto-Isolator
(Same as MCT 2 or 4N25)
2/99¢

SN 76477

SOUND GENERATOR
Generates Complex Sounds
Low Power - Programmable
3.95 each

TV GAME CHIP AND CRYSTAL

AY-3-8500-1 and 2.01 MHZ Crystal (Chip & Crystal includes score display, 6 games and select angles, etc. **7.95/set**

EXAR

XR205	$8.40			XR2242CP	1.50
XR210	4.40			XR2264	4.25
XR215	4.40			XR2556	3.20
XR320	1.55	JE2206KA	14.95	XR2567	2.99
XR-L555	1.50	JE2206KB	19.95	XR3403	1.25
XR555	.39	XR1800	3.20	XR4136	1.25
XR556	.99	XR2206	4.40	XR4151	2.85
XR567CP	.99	XR2207	3.85	XR4194	4.95
XR567CT	1.25	XR2208	5.20	XR4202	3.60
XR1310P	1.30	XR2209	1.75	XR4212	2.05
XR1468CN	3.85	XR2211	5.25	XR4558	.75
XR1488	1.39	XR2212	4.35	XR4739	1.15
XR1489	1.39	XR2240	3.45	XR4741	1.47

DIODES

TYPE	VOLTS	W	PRICE	TYPE	VOLTS	W	PRICE
				1N4002	100 PIV	1 AMP	12/1.00
				1N4003	200 PIV	1 AMP	12/1.00
1N746	3.3	400m	4/1.00	1N4004	400 PIV	1 AMP	12/1.00
1N751	5.1	400m	4/1.00	1N4005	600 PIV	1 AMP	10/1.00
1N752	5.8	400m	4/1.00	1N4006	800 PIV	1 AMP	10/1.00
1N753	6.2	400m	4/1.00	1N4007	1000 PIV	1 AMP	10/1.00
1N754	6.8	400m	4/1.00	1N3600	50	200m	8/1.00
1N757	9 0	400m	4/1.00	1N4148	75	10m	15/1.00
1N759	12.0	400m	4/1.00	1N4154	35	10m	12/1.00
1N959	8.2	400m	4/1.00	1N4305	75	25m	15/1.00
1N965	15	400m	4/1.00	1N4734	5.6	1w	28
1N5232	5.6	500m	28	1N4735	8.2	1w	28
1N5234	8.2	500m	28	1N4736	6.8	1w	28
1N5235	8.8	500m	28	1N4738	8.2	1w	28
1N5236	7.5	500m	28	1N4742	12	1w	28
1N5242	12	500m	28	1N4744	15	1w	28
1N5245	15	500m	28	1N1183	50 PIV	35 AMP	1.60
1N456	25	40m	6/1.00	1N1184	100 PIV	35 AMP	1.70
1N458	150	7m	6/1.00	1N1185	150 PIV	35 AMP	1.70
1N485A	180	10m	5/1.00	1N1186	200 PIV	35 AMP	1.80
1N4001	50 PIV	1 AMP	12/1.00	1N1188	400 PIV	35 AMP	3.00

SCR AND FW BRIDGE RECTIFIERS

C36D	15A @ 400V	SCR(2N1849)	$1.95
C38M	35A @ 600V	SCR	1.95
2N2328	1.6A @ 300V	SCR	.50
MDA 980-1	12A @ 50V	FW BRIDGE REC.	1.95
MDA 980-3	12A @ 200V	FW BRIDGE REC.	1.95

TRANSISTORS

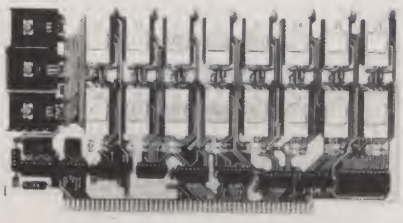
C106B1	.50			2N3904	4/1.00
MPSA05	.30	2N3055	.89	2N3905	4/1.00
MPSA06	5/1.00	MJE3055	1.00	2N3906	4/1.00
TIS97	8/1.00	2N3392	5/1.00	2N4013	3/1.00
TIS98	8/1.00	2N3398	5/1.00	2N4123	8/1.00
40409	1.75	PN3567	3/1.00	PN4249	4/1.00
40410	1.75	PN3568	4/1.00	PN4250	4/1.00
40673	1.75	PN3569	4/1.00	2N4400	4/1.00
2N918	4/1.00	MPS3638A	5/1.00	2N4401	4/1.00
2N2219A	2/1.00	MPS3702	5/1.00	2N4402	4/1.00
2N2221A	4/1.00	2N3704	5/1.00	2N4403	4/1.00
2N2222A	5/1.00	MPS3704	5/1.00	2N4409	5/1.00
PN2222 Plastic	7/1.00	2N3705	5/1.00	2N5086	4/1.00
2N2369	5/1.00	MPS3705	5/1.00	2N5087	4/1.00
2N2369A	4/1.00	2N3706	5/1.00	2N5088	4/1.00
MPS2369	5/1.00	MPS3706	5/1.00	2N5089	4/1.00
2N2484	4/1.00	2N3707	5/1.00	2N5129	5/1.00
2N2906	4/1.00	2N3711	5/1.00	PN5134	5/1.00
2N2907	5/1.00	2N3724A	65	PN5138	5/1.00
PN2907 Plastic	7/1.00	2N3725A	1.00	2N5139	5/1.00
2N2925	5/1.00	2N3772	2.25	2N5210	5/1.00
MJE2955	1.25	2N3823	1.00	2N5449	3/1.00
2N3053	2/1.00	2N3903	5/1.00	2N5951	3/1.00

CAPACITOR CORNER

50 VOLT CERAMIC DISC CAPACITORS

	1-9	10-99	100+		1-9	10-99	100+
10 pf	.05	.04	.03	001μF	.05	.04	.035
22 pf	.05	.04	.03	.0047μF	.05	.04	.035
47 pf	.05	04	.03	.01μF	.05	.04	.035
100 pf	.05	.04	.03	.022μF	.06	.05	.04
220 pf	.05	.04	.03	.047μF	.06	.05	.04
470 pf	.05	.04	.035	.1μF	.12	.09	075
100 VOLT MYLAR FILM CAPACITORS							
.001mf	.12	.10	.07	.022mf	13	.11	.08
.0022	.12	.10	.07	.047mf	.21	.17	13
.0047mf	.12	.10	.07	.1mf	27	.23	.17
.01mf	12	10	.07	22mf	33	.27	.22
+20% DIPPED TANTALUMS (SOLID) CAPACITORS							
.1/35V	.28	.23	.17	1.5/35V	.30	26	.21
.15/35V	.28	.23	17	2.2/25V	.31	27	.22
.22/35V	.28	.23	.17	3 3/25V	.31	.27	.22
.33/35V	28	.23	.17	4.7/25V	.32	28	.23
47/35V	.28	.23	.17	6.8/25V	.36	.31	.25
.68/35V	.28	.23	.17	15/25V	.63	.50	.40
1.0/35V	.28	.23	.17				
MINIATURE ALUMINUM ELECTROLYTIC CAPACITORS							
Axial Lead				Radial Lead			
.47/50V	.15	.13	.10	.47/25V	.15	.13	.10
1.0/50V	.16	.14	.11	.47/50V	.16	.14	.11
3.3/50V	.14	.12	.09	1.0/16V	15	.13	10
4.7/25V	.15	13	.10	1.0/25V	.18	.14	.11
10/25V	.15	.13	.10	1.0/50V	.16	.14	.11
10/50V	16	14	.12	4.7/16V	.15	.13	.10
22/25V	.17	.15	.12	4.7/25V	.15	.13	.10
22/50V	.24	.20	.18	4.7/50V	.16	.14	.11
47/25V	.19	.17	.15	10/16V	.14	.12	.09
47/50V	.25	.21	.19	10/25V	15	.13	.10
100/25V	.24	.20	.18	10/50V	.16	.14	.12
100/50V	.35	.30	.28	47/50V	.24	.21	.19
220/25V	.32	.28	.25	100/16V	.19	.15	.14
220/50V	45	.41	.38	100/25V	.24	.20	.18
470/25V	33	.29	.27	100/50V	.35	.30	.28
1000/16V	.55	.50	.45	220/16V	.23	.17	.18
2200/16V	.70	.62	.55	470/25V	.31	.28	.26

16K EPROM CARD-S 100 BUSS



$59.95 KIT

OUR BEST SELLING KIT!

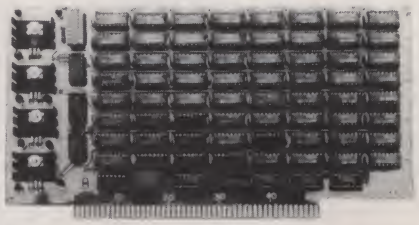
USES 2708's!

Thousands of personal and business systems around the world use this board with complete satisfaction. Puts 16K of software on line at **ALL TIMES!** Kit features a top quality soldermasked and silk-screened PC board and first run parts and sockets. All parts (except 2708's) are included. Any number of EPROM locations may be disabled to avoid any memory conflicts. Fully buffered and has WAIT STATE capabilities.

OUR 450NS 2708'S ARE $8.95 EA. WITH PURCHASE OF KIT

ASSEMBLED AND FULLY TESTED ADD $25

8K LOW POWER RAM KIT-S 100 BUSS 250 NS SALE!



ADD $5 FOR 250NS!

$129 KIT

(450 NS RAMS!)

Thousands of computer systems rely on this rugged, work horse, RAM board. Designed for error-free, NO HASSLE, systems use.

KIT FEATURES:

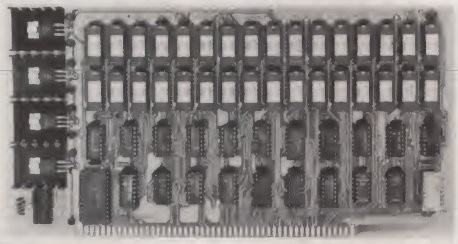
1. Doubled sided PC Board with solder mask and silk screen layout. Gold plated contact fingers.
2. All sockets included.
3. Fully buffered on all address and data lines.
4. Phantom is jumper selectable to pin 67.
5. FOUR 7805 regulators are provided on card.

Blank PC Board w/Documentation **$29.95**
Low Profile Socket Set...**13.50**
Support IC's (TTL & Regulators) **$9.75**
Bypass CAP's (Disc & Tantalums) **$4.50**

ASSEMBLED AND FULLY BURNED IN ADD $30

16K STATIC RAM KIT-S 100 BUSS

$295 KIT



FULLY STATIC, AT DYNAMIC PRICES

WHY THE 2114 RAM CHIP?

We feel the 2114 will be the next industry standard RAM chip (like the 2102 was). This means price, availability, and quality will all be good! Next, the 2114 is FULLY STATIC! We feel this is the **ONLY** way to go on the S-100 Buss! We've all heard the HORROR stories about some Dynamic Ram Boards having trouble with DMA and FLOPPY DISC DRIVES. Who needs these kinds of problems? And finally, even among other 4K Static RAM's the 2114 stands out! Not all 4K static Rams are created equal! Some of the other 4K's have **clocked** chip enable lines and various timing windows **just as critical** as Dynamic RAM's. Some of our competitor's 16K boards use these "tricky" devices. But not us! The 2114 is the ONLY logical choice for a trouble-free, straightforward design.

KIT FEATURES:
1. Addressable as four separate 4K Blocks.
2. ON BOARD BANK SELECT circuitry. (Cromemco Standard!). Allows up to 512K on line!
3. Uses 2114 (450NS) 4K Static Rams.
4. ON BOARD SELECTABLE WAIT STATES.
5. Double sided PC Board, with solder mask and silk screened layout. Gold plated contact fingers.
6. All address and data lines fully buffered.
7. Kit includes ALL parts and sockets.
8. PHANTOM is jumpered to PIN 67.
9. LOW POWER: under 2 amps TYPICAL from the +8 Volt Buss.
10. Blank PC Board can be populated as any multiple of 4K.

BLANK PC BOARD W/DATA **$33**
LOW PROFILE SOCKET SET—**$12** ASSEMBLED & TESTED—**ADD $30**
SUPPORT IC'S & CAPS—**$19.95** 2114 RAM'S—**8 FOR $69.95**

16K STATIC RAM SS-50 BUSS

$295 KIT

FULLY STATIC AT DYNAMIC PRICES

NEW!

KIT FEATURES:

FOR SWTPC 6800 BUSS!

1. Addressable on 16K Boundaries
2. Uses 2114 Static Ram
3. Runs at Full Speed
4. Double sided PC Board. Solder mask and silk screened layout. Gold fingers.
5. All Parts and Sockets included
6. Low Power: Under 2 Amps Typical

BLANK PC BOARD—**$33** COMPLETE SOCKET SET—**$12**
SUPPORT IC'S AND CAPS—**$19.95**

TM990 BUSS PROTOTYPE & WIREWRAP BOARD

For use with the Texas Instrument Series of 16 Bit Microcomputer Modules. Fully buss compatible. An inexpensive and quick way to expand the capacity of your TI computer. Made of G-10 Epoxy PC material. Gold plated contact fingers all plated through holes. High density, up to over 100 DIP's. Fully documented. **$70 each (OEM Discounts Available)**

450 NS! 2708 EPROMS

Now full speed! Prime new units from a major U.S. Mfg. 450 N.S. Access time. 1K x 8. Equiv. to 4-1702 A's in one package.

~~$15.75 ea.~~ **$9.95** ~~4 For $50.00~~

PRICE CUT

ANNOUNCEMENT:

To better serve our customers we are splitting Digital Research Corp of Texas into two operating sections: Parts and Computers. We feel this change will allow us to offer you lower prices, better service, and many more new products. Continue to order parts, clock modules, etc. from D.R.P. P.O. Box 401247 Garland, TX 75040. To order computer parts and computer kits order from Digital Research: Computers P.O. Box 401565 Garland, TX 75040.

Z-80 PROGRAMMING MANUAL

By MOSTEK, or ZILOG. The most detailed explanation ever on the working of the Z-80 CPU CHIPS. At least one full page on each of the 158 Z-80 instructions. A MUST reference manual for any user of the Z-80. 300 pages. Just off the press. **$12.95**

NOT ASSOCIATED WITH DIGITAL RESEARCH OF CALIFORNIA, THE SUPPLIERS OF CPM SOFTWARE.

16K DYNAMIC RAM CHIP

16K X 1 Bits. 16 Pin Package. Same as Mostek 4116-4. 250 NS access. 410 NS cycle time. Our best price yet for this state of the art RAM. 32K and 64K RAM boards using this chip are readily available. These are new, fully guaranteed devices by a major mfg. **VERY LIMITED STOCK!**
8 FOR $79.50

Digital Research: Computers (OF TEXAS) D20

P.O. Box 401565 • GARLAND, TEXAS 75040 • (214) 271-2461

TERMS: Add 50¢ postage, we pay balance. Orders under $15 add 75¢ handling. No C.O.D. We accept Visa, MasterCharge, and American Express cards. Tex. Res. add 5% Tax. Foreign orders (except Canada add 20% P & H. 90 Day Money Back Guarantee on all items.

ADVANCED COMPUTER PRODUCTS

NEW CATALOG AVAILABLE NOW!

✓A38

THE FIRST TO OFFER PRIME PRODUCTS TO THE HOBBYIST AT FAIR PRICES NOW LOWERS PRICES EVEN FURTHER!

1. Proven Quality Factory tested products only, no re-tests or fallouts. Guaranteed money back. We stand behind our products.

1979 CATALOG NOW AVAILABLE.

Send $1.00 for your copy of the most complete catalog of computer products. A must for the serious computer user.

STATIC RAM BOARDS

Now, just more than 1¼¢ per bit!

S-100 32K (uses 2114)

	Kit
ASSEMBLED	
450ns. 599.00	450ns. 539.95
250ns. 699.95	250ns. 599.95
Bare Board 49.95	
Bare Board w/all parts less mem. 99.95	

S-100 16K (uses 2114) KIT (exp. to 32K)

ASSEMBLED	450ns. 279.00
450ns. 325.00	250ns. 299.00
250ns. 375.00	
Bare Board 49.95	

LOGOS I 8K

ASSEMBLED	
450 ns. 169.95	KIT 450ns. 125.95
250ns. 189.95	250ns. 149.95

Bare PC Board w/Data $21.95
Now over 1 year successful field experience
"Special Offer" Buy (4) 8K 450ns. Kits $117.00

FLOPPY DISK DRIVES

1. VISTA V-80 MINIDISK FOR TRS-80
   - ★ 23% More Storage Capacity - 40 Tracks
   - ★ Faster Drive - Up to 8 Times Faster
   - 2 Drive Cable Add $29.95
   - 4 Drive Cable Add $39.95

   395.00
2. VISTA V-200 MINI-FLOPPY SYSTEM
   - ★ 204K Byte Capacity ★ w/CPM, Basic "E"
   - ★ One Single Sided, Double Density Drive
   - ★ One Double Density Controller w/Case & P.S.

   V-200 699.00

   Add to your EXIDY, HORIZON, etc.
3. VISTA V-1000 FLOPPY DISK SYSTEM
   - ★ (2) Shugart 800-R 8" Floppy Disks
   - ★ Controller Card, Cable, Case & P.S.
   - ★ CPM & Basic "E", Instructions & Manual

   V-1000 1699.00
4. MPI B51-5¼", 40 tracks 279.00
5. Shugart SA400-5¼", 35 tracks 295.00
6. Siemens/GSI FDD100-8 8" 375.00
7. Shugart 800/801R 8" 495.00
8. PERSCI Model 277 Dual 1195.00

EXPANDORAM MEMORY KITS

- ★ Bank Selectable ★ Uses 4115 or 4116 200 ns.
- ★ Write Protect ★ Power 8VDC, ±16VDC
- ★ Phantom ★ Lowest Cost/Bit

Expando 32 Kit (4115)	Expando 64 Kit (4116)
8K $179.00	16K $248.95
16K $229.00	32K $369.00
24K $299.00	48K $469.00
32K $349.00	64K $565.00

IMS STATIC RAM BOARDS

$699.00

- ★ Memory Mapping ★ Low Power
- ★ Phantom ★ Assembled & tested

Recommended by Alphamicrosystems

	250 ns.	450 ns.
8K Static	$209.00	$189.00
16K Static	$449.00	$399.00
32K Static	$799.00	$699.00

ANADEX PRINTER

Model DP-8000 compact, impact, parallel or serial. Sprocket feed, 80 cols, 84 lines/min., bi-directional. New only $895.00

VERBATIM™ DISKETTES

LOW PRICE TOP QUALITY DISKETTES

- ★ 5¼" Minidiskettes ★ Softsector, 10 Sector, 16 Sector $4.25 Each, 10/39.95
- ★ 8" Standard Floppy Disks ★ Soft Sector, Hard Sector $4.50 Each, 10/41.95

*Add 4.95 for 10 Pack in Deluxe Disk Holder

6800

MOTOROLA EXORCISER COMPATIBLE

9600 MPU Module w/6802 CPU	$495.00
9601 16 Slot Mother Board	175.00
9602 Card Cage (19" Retma Rack Mount)	75.00
9603 8 Slot Mother Board	100.00
9604 Switchmode System Power Supply	250.00
9610 Utility Prototyping Board	36.00
9616 Quad 8K Eprom Module	***
9620 16 Channel Parallel I/O Module	295.00
9622 Serial/Parallel I/O Combo	***
9626 8K Static RAM Module	295.00
9627 16K Static 450ns	495.00
9630 Card Extender	68.00
9640 Multiple Programmable Timer (24 Timers)	395.00
9650 8 Channel Duplex Serial I/O	395.00
96103 32/32 I/O Module	275.00
96702 32 Point Reed Relay Module	350.00

6800 BARE BOARDS

9620-0	$45.00	9603-0	27.00
9626-0	45.00	9600	55.00
9650-0	45.00	96103	55.00
9601-0	50.00	96702	55.00

Also AMI EVK System in Stock

APPLE/EXIDY/EXPANDO TRS 80 16K-UPGRADE KIT

- ★ 16K with Jumpers & Instructions for either Level I or Level II $89.95
- ★ 16K for Apple II Upgrade..... $89.95

Special: TRS80 Schematic..... $ 4.95
Expansion Interface Schematic .... $ 4.95

TRS 80 TO S-100 PET TO S-100 ADAPTER

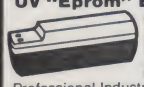
Allows Pet/TRS 80 to be interfaced to popular S-100 Bus.

Pet to S-100 Kit $189.95
Assembled..... $269.95
TRS 80 to S-100 HUH 8100 Kit $275.00
Assembled..... $355.00

KEYBOARD ASCII ENCODED

One time purchase of NEW Surplus keyboards. From the Singer Corporation. The keyboard features 128 ASCII characters in a 63 key format, MOS encoder circuitry "N" key rollover, lighted shift lock, control, escape and repeat functions. Ltd Qty **63 KEY $59.95**

UV "Eprom" Eraser



Model UVs-11E $64.95
Holds 4 Eprom's at a time. Backed by 45 years experience.
Model S-52T...$219.95
Professional Industrial Model

TARBELL FLOPPY INTERFACE

★ Z80/8080 S100 Compatible ★ Uses CPM
Assembled for Shugart... **SALE $229.00**
Assembled Other Drives..... $269.95
Kit $179.95
Bare Board ..... $36.95 (Doc. Add $10.00)
Note: For CPM Add 70.00. Documentation Add $20.00

Vista Double Density 5¼" Controller Assem..... $299.00
SD Versa Floppy Kit..... $159.95
SD Versa Floppy Assembled..... $189.95
Tarbel Cassette I/O Kit..... $115.00
Sale ★ 1771-01 Floppy Chip..... $27.95

BYTE USER 8K EPROM BOARD

★ Power on Jump ★ Reset Jump
Assembled & Tested..... $94.95
Byteuser Kit..... $64.95
Bare PC Board..... $21.95
Special Offer: Buy 4 kits only $59.95 each
MR-8 8K w/1K Ram..... $99.50
MR-16 16K w/1K Ram..... $99.50
EPM-1 4K 1702..... $59.95
EPM-2 2708 or 2716 Eprom..... $69.95

Z-80/Z-80A/8080 CPU BOARD

★ On board 2708 ★ 2708 included (450ns.)
★ Power on jump ★ completely socketed
Assembled and tested..... $185.00
Kit..... $129.95
Bare PC Board..... $ 34.95
★ For 4MHz Speed Add $15.00
8080A Kit..... $ 99.95
8080A Assembled..... $149.95

S-100 MOTHERBOARD SPECIAL

8 slot expandable w/9 conn.
reg $69.95..... NOW $52.95

TARBELL FLOPPY CONTROLLER

Card assembled and tested for use with Shugart Drives $ SALE PRICE only $229.00

ACOUSTIC MODEM

NOVATION CAT™
0-300 Baud
Bell 103
Answer, Originate $198.00

ACOUSTIC COUPLER SPECIAL

AJ MODEL A30
SPECIAL PURCHASE
OF SURPLUS UNITS
AVAILABILITY LIMITED $29.95

DATA BOOKS • COMPUTER BOOKS

1978 IC Master	49.95	Intel MCS 80 Manual	7.95
NSC TTL Data	3.95	Intel MCS 40 Manual	4.95
NSC Linear	4.95	AMD 8080A Manual	5.95
NSC Linear App Notes II	3.95	AMD Schottky Databook	4.95
NSC CMOS	3.95	AMI MOS/LSI Data	3.95
NSC Memory	3.95	GI MOS/LSI Data	4.95
Intel Databook	4.95	Harris Analog Databook	4.95
Intel MCS 85 Manual	7.50	TI Linear Control Data	3.95

SALE • OSBORNE BOOKS • SALE

	Reg.	Sale
Intro to Micros Vol. 0	8.50	7.75
Intro to Micros Vol. I	8.50	7.75
8080A Programming	8.50	7.75
6800 Programming	8.50	7.75
Z80 Programming	8.95	7.75
Vol. II Some Real Microprocessors w/Binder	30.00	27.50
Vol. III Some Real Support Devices w/Binder	20.00	18.50
Intro to Micros Vol. III	20.00	18.50

SALE • DILITHIUM COMPUTER BOOKS • SALE

Understanding Computers	7.95	7.95
8080Microcomputer Experiments	13.95	11.95
Beginning BASIC	9.95	8.95
Beginners Glossary & Guide	7.95	5.95
Peanut Butter & Jelly Guide to Computers	7.95	6.95
8080 Machine Language Programming	7.95	6.95
Home Computers Vol. I Hardware	7.95	6.95
Home Computers Vol. II Software	13.95	11.95
Starship Simulator	7.95	6.95

MICROPROCESSORS

Z-80	$16.95
Z-80A	18.95
F-8 (3850)	18.95
2650	19.95
CD1802	19.95
8080A	9.95
8080A-4MHz	19.95
SALE 8085	**19.95**
8008-1	14.95
2901	24.95
2901A	24.95
TMS 9900JL	49.95
CP1600	39.95
6502	11.50
6502A	19.95
IM6100	29.95
6800	16.95
6802P	24.95
8035	17.50
8755	49.95
8748	69.95

SUPPORT DEVICES

AM9511 Arith Processor	$195.00
AM 9511-1 300 ns	245.00
AM9517 DMA Controller	71.95
AM9519 Universal Interrupt	24.95
3881 (Z80 PIO)	10.45
3881-4 (4MHz)	14.95
3882 (Z-80 CTC)	10.45
3882-4 (4MHz)	14.95
8205/74S138 Decoder	2.95
8212 8 bit I/O	2.50
8214 Priority Int.	4.95
8216 Bus Driver	2.50
8224 Clock Gen	2.95
8224-4 (4MHz)	9.75
8226 Bus Driver	3.95
8T26 Bus Driver	2.39
8228 Sys Control	5.95
8238 Sys Cont	6.25
8251 Prog I/O	6.95
8253 Int Timer	19.50
8255 Prog I/O	6.50
8257 Prog DMA	19.50
8259 Prog Int	19.50
8275 CRT Controller	74.95
8279 Prog Keyboard	19.95
6810-1 128 x 8 RAM	4.75
6820 PIA	6.50
6821 PIA	8.50
6828 Priority Int	11.00
6834-1 512 x 8 Eprom	12.95
6850 ACIA	7.20
6852 Serial Adapter	9.95
6845 HD46505 CRT Contr	39.95
6860 Modem	9.95
6862 Modulator	11.95
6871A 1.0MHz OSC	25.95
6875	8.25
6880 Bus Driver	2.39
MC68488	19.95
1821 SCD 1K RAM	25.00
1822 SCD 256 x 4 RAM	16.95
1824 CD 32 x 8 RAM	9.95
1852 CD 8 bit I/O	10.95
1854 Uart	10.95
1856 CD I/O	8.95
1857 CD I/O	8.95
6520 PIA	7.50
6522 Mult	9.25
6530-002	15.50
6530-003	15.50
6530-004	15.50
6530-005	15.50
3851 F8 Prog Store	14.95
3853 F8 Memory I/O	14.95

DYNAMIC RAMS

416/4116 16K (16 Pin)	12.45
Set of 8 416's	89.95
4115 8K (18 Pin)	6.95
4050 4K x 1 (18 Pin)	4.25
4060 4K x 1 (22 Pin)	4.95
4096 4K x 1 (16 Pin)	3.95
2104 4K x 1 (16 Pin)	4.75
4027 4K x 1 (16 Pin)	4.95
5261 1.95 1103	1.95
5262 1.95 4008L	4.95
5270 4.95 6605	7.95
5280 4.95 6604	4.95
5290 12.45 6002	1.50

PROMS

2708	9.95
2708-6	7.50
1702A	3.95
1702A-6	3.50
2716-5V	59.95
2716-5V, 12V	40.00
2758 5V	29.95
5203AQ	11.95
5204AQ	9.95
6834-1	12.95
IM 5610	9.95
SALE 8223 32 x 8	**2.95**
82S115 512 x 8 (TS)	16.95
82S123 32 x 8	2.50
82S126 256 x 4	3.50
82S129 256 x 4 (TS)	3.50
82S130 512 x 4 (OC)	6.50
NSC DM75/8 32 x 8	2.95

CHARACTER GEN

2513-001 (5V) Upper	9.50
2513-005 (5V) Lower	10.95
2513-ADM3 (5V) Lower	14.95
MCM6571	10.75
MCM6571A	10.75
MCM6574	14.50
MCM6575	14.50

UARTS/USRTS

TR1602B (5V 12V)	3.95
AY51013 (5V 12V)	4.95
AY51014A/1512 (5V 14V)	6.95
AY51015A/1863 (5V)	6.95
TMS 6011 (5V 12V)	5.50
IM6402	7.95
IM6403	8.95
2350 USRT	9.95
16718 Astros	24.95
SALE TR1472B	**9.95**

BAUD RATE GEN

MC14411	11.95
4702	14.95
WD1941	9.95

KEYBOARD ENCODERS

AY5-2376	13.75
AY5-3600	13.75
HD0165	9.95
74C922	9.95
74C923	9.95

A/D CONVERTERS

8700 8 bit Binary	13.50
8701 10 bit Binary	22.00
8703 8 bit TS	13.50
9400 Volt to Freq. Conv	7.25
8750 3-1/2 Digit BCD	13.95
1408L6 6 bit	3.95
1408L8 8 bit	5.95
DACOI A/D	5.95

STATIC RAM HEADQUARTERS

	1-24	25-99	100
21L02 450ns	1.30	1.25	1.15
21L02 250ns	1.59	1.55	1.45
2102	1.25	1.15	1.10
2111	3.75	3.65	3.55
2112-1	2.95	2.85	2.65
2101-1	2.90	2.70	2.55
2114L-250ns	12.95	10.95	9.95
2114L-300ns	8.95	7.95	6.45
2114L-450ns.	7.50	6.75	**4.75**
4044/4041 300ns	9.95	8.75	7.95
4044/4041 450ns.	7.50	6.75	**4.75**
EMM4200A	9.75	8.75	7.95
EMM4402	7.95	7.25	6.25
EMM4804	12.50	11.50	9.95
5101CE	7.95	7.95	7.25
upd410 (4200)	10.95	10.25	9.25
AMD9140 41	10.95	10.25	9.25
AMD9130-31	12.95	11.95	10.25
FSC 460 46416K CCD Only $1.95 Each			
1101	1.95	1.75	1.25
P2125-93425 (45 ns)	7.95	7.35	7.25
6508 1K x 1 CMOS	7.95	7.95	7.25
6518 1K x 1 CMOS	7.95	7.95	7.25
74S189 64 bit Ram	3.95	3.25	2.50
8155 I/O w Ram 21.95			
2147 Low Power 4K Static 14.95 ea.			

CHARGE COUPLED DEVICES

16K CCD - First time offered Fairchild 460 CCD 16K Memory (now you can experiment with CCD technology at a reasonable price 17 page Application note supplied with each order. Quantity limited)

$18.95 each (reg. 43.00)

CRYSTALS

Microprocessor Timebases TV Game

Frequency	Price	Frequency	Price
1.0MHz	$5.85	6.0MHz	$ 4.95
1.8432	4.95	6.144	4.95
2.0MHz	5.85	6.5536	4.95
2.01MHz	2.95	10.0MHz	4.95
2.097152MHz	5.85	13.0MHz	4.95
2.4576MHz	5.85	14.31818	4.95
3.579545MHz	4.50	18.0MHz	4.95
4.0MHz	4.95	18.432MHz	5.95
4.194304MHz	5.95	20.0MHz	4.95
4.91520MHz	5.95	22.1184MHz	5.95
5.0MHz	4.95	27.0MHz	5.95
5.0688	4.95	36.0MHz	5.95
5.7143MHz	5.95	48.0MHz	5.95
		100KC	12.95

DISPLAYS/OPTO/LED'S

★ 7 SEGMENT ★ CALC ★ CLOCKS ★

DL 704 (CC) DL 707 (CA) .300" Red	99
FND 357 (CC) .357" Red	99
FND 500/503 (CC) .500" Red	99
FND 507/510 (CA) .500" Red	99
FND 800/803 (CC) .800" Red	1.75
FND 807/810 (CA) .800" Red	1.75
XAN 3062 .500" Green	1.15
HPS082-7731 (CA) .300" Red	99
9 Digit Bubble Mini Calc Display	99
9 Digit Panaplex Display .400"	99
9 Digit Fluorescent .300"	99
MA1003 12V Auto Clock Module	**15.95**
Bezel for MA1003 w/Red Filter	4.95
MA1002A LED 12 hr. Clock Module	10.95

★ HEX DISPLAYS ★ ENCODED DISPLAYS ★

HP 5082-7340 Red Hexidecimal	15.95
HP 5082-7300 Red Numeric	14.95
TIL 306 Numeric w/Logic	8.95
TIL 308 Number w/Logic	8.95
TIL 309 Number w/Logic	8.95
TIL 311 Hexadecimal	12.95
MAN 2A .320" Red Alpha-Numeric	5.95
MAN 10A .270" Red Alpha-Numeric	8.95

★ LED's ★ OPTOISOLATERS ★

LEDS Red, Yellow, Green .185"	5/1.00
MCT 2 Photo XSTR HFE 250, 30V	.99
4N25 Photo XSTR HFE 250, 30V	1.29
4N33 Photo Darlington	1.75
FPT 110B Photo XSTR Flat Lense	**SALE** 4/1.00

ATTENTION KIM USERS

KIMSAI-expansion to S-100	125.00 Kit/165.00
KIMSI to KIM Connector	5.75/pair
KIM 1.0/2 Single Board Computer	179.00
KIM 1 Power Supply	59.95
KIM Memory Plus - (consists of 8K Ram, 8K2716 Eprom, Programmer, I/O etc.).	245.00
KIM SOFTWARE	
• Please package (cassette) 12 games	16.95
• Help Editor package (cassette)	16.95
• Help Meeting List pkg (cassette)	16.95
• Help Info Retrival pkg (cassette)	16.95
• Microchess (cassette)	16.95
• Microad Assembly/Disassem/Editor	27.95
• Microaid Source Listing (cassette)	27.95
• Tiny Basic for KIM (paper tape)	10.95

COMPUTER SPECIALS

WOW!

	LIST	SALE
HiPlot Plotter	1095.00	899.00
HiPlot Digitizer	795.00	735.00
Exidy w/32K	1395.00	1195.00
Apple II w/16K	1195.00	1045.00
Compucolor II w/16K	1695.00	1595.00
TEI PT208 (1 avail)	4995.00	3995.00
Cromemco Sys III	5990.00	5395.00
Commodore Pet	795.00	765.00
Soroc IQ/120	995.00	695.00
ADM3A Assem	995.00	829.00
Teletype 43	1349.00	1150.00
Centronics P-1	495.00	395.00
Centronics S-1	595.00	525.00

MONTHLY IC SPECIALS

LF13508 JFET Anlog Multi 8 bit			8.95
ICM7208 Seven Decade Counter			17.95
ICM7207 Oscillator Controller			6.95
ICM7045 Precision Sto/Watch Timer			22.95
ICL7107 3½ Digit A/D LED			14.95
ICL8211 Voltage Reference			1.95
LM390 Battery OP Audio Amp			3/1.00
LM1310 Fluid Detector			3/1.00
LM1850 Ground Fault IC			3/1.00
LM1800 Phase Lock Loop FM Stereo			3/1.00
LM1820 AM Radio			3/1.00
DS3625 Dual Mos Sense Amp			2.95
1408L8	4/19.95	10147 ECL Ram	9.95
1488/1489	2/1.99	NE561	5.00
22 Pin S/T Socket 10/1.00		LF356H/BiFet	3/1.99
8223 Prom	2.95	MCM14505	8.95
6331-1 Prom	1.95	74S89	3/1.99
MK5014 Calc	2/1.99	74107N	6/1.99
7414 N	3/1.99	75452N	8/1.99
LM2917	2.25	7411-14	10/1.99
8T26/8T28	2.39	555CN	5/1.99
95H90	9.95	556CN	3/1.99

ATTENTION APPLE II USERS

Apple II w/16K	$1045.00
16K Upgrade Kit	89.95
Floppy Disk II w/Interface	595.00
Floppy Disk II	495.00
Firmware Card	180.00

SOCKETS

8 Pin W W	.32	8 Pin S T	17
14 Pin W W	.37	14 Pin S T	20
16 Pin W W	.38	16 Pin S T	.22
18 Pin W W	.60	18 Pin S T	.31
20 Pin W W	.90	20 Pin S T	.34
22 Pin W W	.93	22 Pin S T	.35
24 Pin W W	.85	24 Pin S T	.41
28 Pin W W	1.15	28 Pin S T	.49
40 Pin W W	1.49	40 Pin S T	.61

TEXTOOL ZERO INSERTION FORCE SOCKETS

16 Pin $ 5.50 24 Pin $7.50
40 Pin $10.25

CONNECTORS

DB25P (RS232)	3.25
DB25S Female	3.75
Hood	1.25
Set w/Hood, Sale	$6.50
22/44 W/W, S/T, KIM	2.95
43/86 W/W, S/T, MOT	8.50
50/100 S-100 Connector w/w	4.25
50/100 S-100 Connector s/t	3.25

CTS DIPSWITCHES

CTS206-4 $1.75	CTS206-8 $1.95
CTS206-5 $1.75	CTS206-9 $1.95
CTS206-6 $1.75	CTS206-10 $1.95
CTS206-7 $1.75	

LIVERMORE BASIC

ON 65K ROM
THAT'S RIGHT ON ROM!!!
OUR PRICE only $95.00

NAKED PC BOARD SALE

Z-80 CPU (Ithaca)	$34.95
8080A CPU	34.95
8K Static RAM (Logos)	21.95
16K Static RAM (2114)	29.95
32K Static RAM (2114)	49.95
Floppy I/O (Tarbell)	39.95
Cassette I/O (Tarbell)	29.95
8K Eprom (2708)	21.95
1702 Eprom Board	30.00
2708/2716 Eprom (Ithaca)	34.95
2708/2716 Eprom (WMC)	30.00
Realtime Clock	34.95
ACP Photo Bd (JM Conn)	27.95
Vector 8800 Photo	19.95
Vector 8803 11 slot MB	29.95
ACP Extender w/Conn	15.95
Video Interface (SSM)	27.95
Parallel Interface (SSM)	27.95
13 Slot MotherBoard (WMC)	32.95
9 Slot MotherBoard (WMC)	29.95
8 Slot Mother (expandable)	34.95

WAVEFORM GENERATORS

8038 Function Gen	3.95
MC4024 VCO	2.45
LM566 VCO	1.75
XR2206 Function Generator	5.25

FLOPPY DISK I/O

1771-01 8" & Minifloppy	27.95
uPD372 Nec Floppy	49.95
1781 Dual Floppy	39.95
1791 Dual Floppy	44.95

TV INTERFACES

Pixie-Verter	8.50
TV-1 Video Interface	8.95
Microverter	35.00
M&R Modulator	35.00

ATTENTION PET USERS

BETSI-pet expansion to S100 ..... 105.00 Kit/180.00

PET Connector Kit Includes (4) Connectors for memory expansion, IEEE 488 I/O, cassette I/O and parallel user port..... 7.95/set

Video Buffer
(converts to Std Video) 29.95
Petunia (Music Board) 29.95
Combo (Video & Petunia) 49.95
Beeper (signals tape load) 24.95

ATTN TRS 80 USERS

20/40 Pin Memory Exp. Conn $7.95

16K Memory Add-on w/Inst	89.95
Vista V80 Minifloppy	395.00
40 Track DOS Patch on Disk	10.95
4 Drive Cable for V80	39.95
Centronics 779 w/tractor	1179.00
Centronics 701 Bidirect	1579.00
ANADEX DP8000	995.00
Micro-P (same as Quick Printer)	395.00
Cable to plugin Expansion I/O	39.00
Power Strip (6 outlets)	17.95
Surge Suppressor/Filter	23.95
Microsoft Fortran on Disk	325.00
Electric Pencil on Cassette	99.00
Electric Pencil on Disk	150.00
CP/M for TRS on Disk	150.00
Library 100 (cassettes)	49.95
Micro Chess (cassette)	19.95

TV CHIPS

AY 38550-1 8 Games Color w 8515	$8.95
AY 38500-1 8 Games B W	4.95
AY 38115 Color Converter	7.95
AY 38603-1 Roadrace Game	8.95
AY 38605-1 Warfare Game	9.50
AY 38606-1 Wipeout Game	9.50
AY 38607-1 Shooting Gallery	8.95
AY 38610-1 10 Games Color w 8615	9.50
AY 38615 Color Converter	7.95
AY 38910 Games Cricket Sound Generator	12.95
SN 76477 TI Sound Generator	3.95
MM5320-21 TV Sync Gen	9.95
MM5369 Prescaler	3.95
LM1889 RF Modulator	3.95
MM5730 NTSC Color TV Game	8.95
MM5784 Clock Gen	1.75
RF Modulator w Audio	8.95

All Shipments FCM or UPS. Orders under $100.00 add 5% handling and postage. Orders over $100.00 add 2.5% handling & postage. Mastercharge/Bank americard/COD accepted w/25% deposit. California Residents add 6% tax. Foreign Orders add 8% handling. All parts prime factory tested guaranteed. Same day shipment. Add 35 cents for Data.

Retail pricing may vary from Mail Order Pricing. All pricing subject to change without notice

P. O. BOX 17329 Irvine, California 92713 Phone (714) 558-8813
TWX: 910-595-1565

Retail Store Open Mon. – Sat.
Located at 1310 "B" E. Edinger, Santa Ana, CA 92705

ELECTRONIC COMPONENTS
TEST EQUIPMENT
CONNECTORS-WIRE

WALLEN ELECTRONICS CO. INC. Tel: (617) 588-6440-6441

108 SAWTELL AVE., BROCKTON, MA. 02402

POWER SUPPLIES REGULATED COMPUTER

Ideal for micro and mini computers. These units have been removed from equipment, checked out and guaranteed. 5 volts @ 8 amps + 12 volts. 2 amps + 6 volts @ 75 MA. Power supply has a 3-wire line cord and fused. Dimensions: 10½"x5½"x4½". Shipping weight: 16 lbs.

37.50
2 FOR 70.00

WIRE WRAP BOARDS

These boards are pre-wired and removed from equipment. Easy to unwrap for setting up your own board, contains mostly 14-pin IC sockets with individual pin connections. Each board has VCC and ground planes.

Reduced prices

Smaller board measures 6½"x6" and has 40 to 50 sockets. ~~Price $11.00 ea. 2/$20.00~~ $7.50 ea.2/$14.00

Larger board measures 13½"x6" and has 75 to 100 sockets. ~~Price $17.50 ea. 2/$33.00~~ $12.50 ea.2/$23.00

DIABLO SYSTEM DISC DRIVE

SERIES 40 MODEL 43 100 tracks per inch, total capacity of 50 megabits, w/Model 429 power supply, sector counter, 24 sectors, 1 fixed disc, 1 removable disc, average access time 38 ms, PPM: 2400, dimensions: 10 5/16" high, fits in standard rack, equipped with full extension slides, excellent used condition. Shipped freight collect.

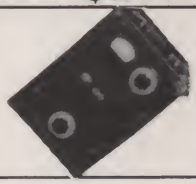
$2495

FM SIGNAL GENERATOR

MEASUREMENTS MODEL 560 FM

Frequency 25 mhz to 80 mhz and 130-175 mhz. Dimensions: 10"x10"x16", weight: 16 lbs. Shipped freight collect. Used. Checked out and operating.

$289



TRANSFORMERS ISOLATION STEP-DOWN TYPE

Primary: 230/115V, 50/60 CPS, Secondary: VA output 250V. $13.95 EACH

I.C.'s

7444	.45	74H72J	.45
7450	.23	74H72N	.30
7453	.23	74H73N	.40
7460	.23	74H76N	.45
7470	.25	74H87N	1.30
7482	.50	74H101J	.65
7490	.35	74H103J	.50
7491	.65	74H108J	.50
74104	.30	74H50	.23
74111	.35	74H40	.23
74121	.30	74H51	.23
74122	.45	74H21	.23
74142	.90	74H30	.23
74145	.45	74SO9	.23
74156	.35	74S134	.25
74180	.45	74S135	.45
74198	1.45	75150	.85
74249	.45	75154	1.25
74265	.35	LM101H	.75
74HO5N	.25	LM318H	1.25
74H15N	.40	NE531T	.80
74H22J	.30	NE565A	.75
74H60N	.23	LM556CN	.75
74H61J	.30	74H61N	.23
74H71N	.30	CA324G	.50
RC741DP	.18	RC747DP	.30

MEMORY PHONES

By FORD INDUSTRIES, INC.

These units have complete installation and operating instructions w/6-foot cord. Colors: beige, white, green, Used, operating condition.

$89

TRENDLINE PHONES

Mfd. by I.T.T.

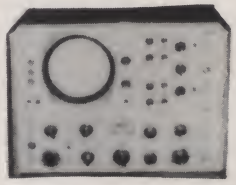
Rotary dial. Colors: white, black, red, green. Packaged, has 6-foot cord and installation instructions. Used, operating condition.

34.50

HEWLETT-PACKARD
Model 175A

OSCILLOSCOPES

These scopes have a 50 Mhz bandwidth and have 2 plug-ins, a 1781B Delay generator and a model 1755A Dual trace vertical amplifier. Dimensions: 13"x17"x25", weight 71 lbs. shipped freight collect. 5" scope. Used. Checked out and operating.



$339

ROTRON WHISPER FANS

Unused, Model Rotron MU 3A1, 230V, AC, 14 watts, 50/60 hz, guaranteed, 4½"x4½"x1½".

$8.95

CRYSTAL
OSCILLATORS

Vectron type CO-23IT crystal freq. 4.9152, MHZ w/tuning option for accuracy of .0001%. 1½"x 1½"x½".R.F.E. 13.95

INCANDESCENT
READOUT ASSEMBLY

Readouts assembled of the 710 series modules. Character 1" high w/lamps. Type No. 344. By Dialco.

1.50 EACH

I.C. SOCKETS

14-PIN Wrap	.30
14-PIN Low Profile	.15
28-PIN Low Profile	.35
40-PIN Low Profile	.50

Minimum order $25.00. Items offered subject to prior sale. FOB, Brockton, Mass. Money order or check w/order. Shipping and handling add 5%. Shipments by parcel post or UPS. No CODs. Mass. residents add 5% sales tax.

nce COMPUMART ✓N7

COMPUTER TERMINAL BREAKTHROUGH

$795

BUY A PET™ AND GET A TERMINAL FREE

commodore

This is not the first terminal built around a microprocessor, but there has never been a terminal at this price which could also be used as a complete computer system. Now the same unit you use for talking to a large time-sharing system can also be used for many other tasks without requiring outside computer support. With the proper software you can handle small jobs such as complex calculations and animated graphics.

Economy through mass production

If an entirely new product was designed specifically to do all the things you can do with the T/C 2001, it would have to cost thousands of dollars. NCE/CompuMart has bypassed a lot of expensive design work by employing a mass-produced computer as the heart of the T/C 2001. The Commodore PET has now been in production for nearly two years and more than 50,000 units have been sold worldwide. There is no other computer at this price which has all these built-in features: 9" TV monitor, 73-key keyboard (larger sizes available), cassette tape drive for loading programs and data, high-level BASIC language, four interfaces and a 24-hour clock. And it's expandable! If you find that you need faster data storage, you can plug in a floppy disk. If you want to be able to print forms or listings, you can attach a printer.

Free tape drive

The 8K PET which costs $795 comes with a built-in tape drive but its keyboard is smaller than the standard typewriter you may be used to. The $995 16K PET and the $1295 32K PET have a standard-sized keyboard but they require an external cassette tape drive for operation. Normally $95, we include it free with each 16K or 32K PET. The T/C 2001 package, worth $69 if purchased separately, is free with any PET ordered from this ad.

FREE 10 DAY TRIAL

NCE/CompuMart has been selling computers by mail since 1971 and we know our business. We know that you need to have complete confidence in the product and the company behind it so we offer you this unconditional guarantee: **Try it for 10 days and if it does not meet all of your expectations, return it for a full refund of your purchase price.** In addition, since the PET is one of the most reliable systems we've ever sold, **we're doubling the manufacturer's warranty on machines ordered from this ad to protect you for a full 6 months against defects in parts or workmanship.** You can't lose; it's our way of assuring satisfaction to those who aren't able to visit our showroom at the NCE/CompuMart store and warehouse in Ann Arbor.

Accessories

Cassette Tape Drive — A second cassette tape drive is required whenever you need to update long files or perform backup copy operations. It plugs directly into the PET and is accessed through the BASIC language. Note: All PETs ordered through this ad include the first tape drive.

Dual Floppy Disk Drive — Programs which take 3 minutes to load from a tape require only seconds to load from a disk. The PET 2040 Dual Floppy Disk Drive requires no extra memory or expansion box, it plugs right in for fast, reliable program and data storage up to 36K. The 2040 is compatible only with the 16K and 32K PETs.

T/C 2001 Terminal Package — If you already own a PET, you can add this valuable option by simply plugging in our special adapter and loading a program from the included tape. Please specify which model PET you have. The output is TTL in the standard serial format, input is RS-232.

How to order — Simply fill out the order blank below or call (313) 994-3200 to place charge card orders. If you don't already have our all-new 48-page NCE Mini-Micro Computer Catalog, check the box and we'll send you one right away.

NCE/COMPUMART • P.O. Box 8610 • 1250 N. Main St. • Ann Arbor, MI 48107

KK89

PHONE ORDERS ACCEPTED (313) 994-3200

- ☐ **8K T/C 2001** **$795.00** plus $10.07 shipping and handling
- ☐ **16K T/C 2001** **$995.00** plus $10.07 shipping and handling
- ☐ **32K T/C 2001** **$1,295.00** plus $10.07 shipping and handling
- ☐ **Dual Floppy Disk Drive** **$1,295.00** plus $7.16 shipping and handling
- ☐ **T/C 2001 Terminal Package** **$69.00** plus $3.99 shipping and handling

☐ **Send me my FREE catalog**

PAYMENT ✓N7

☐ check # _____ ☐ money order

☐ charge

☐ VISA

☐ MASTERCHARGE Interbank # _____

Acct. # _____

Name _____

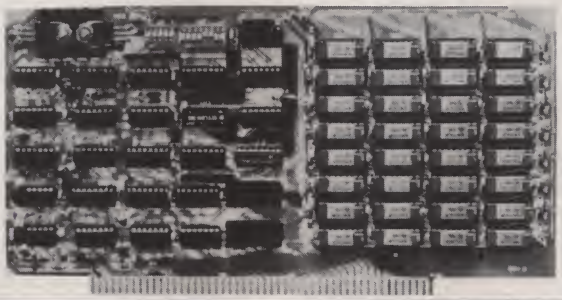
Address _____

City _____

State _____ Zip _____

SD EXPANDORAM

The Ultimate S-100 Memory



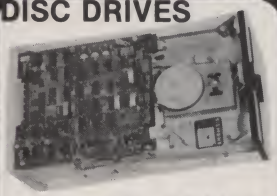
The EXPANDORAM is available in versions from 16K up to 64K, so for a minimum investment you can have a memory system that will grow with your needs. This is a dynamic memory with the invisable on-board refresh, and IT WORKS!

- Bank Selectable
- Phantom
- Power 8VDC, ± 16VDC, 5 Watts
- Lowest Cost Per Bit
- Uses Popular 4116 RAMS
- PC Board is doubled solder masked and has silk-screen parts layout.
- Extensive documentation clearly written
- Complete Kit includes all Sockets for 64K
- Memory access time: 375ns, Cycle time: 500ns.
- No wait states required.
- 16K boundries and Protection via Dip Switches
- Designed to work with Z-80, 8080, 8085 CPU's.

EXPANDO 64 KIT (4116)

16K	$249
32K	$324
48K	$399
64K	$474

DISC DRIVES



Sugart SA400 5¼"
with attractive metal case
$ 325

Sugart 801
with attractive metal case
$495.00

Siemens FDD 200-8 8" double-sided double density
$650.00

DISC CONTROLLER

SD "VERSAFLOPPY" Kit

The Versatile Floppy Disk Controller **Only $159.00**

FEATURES: IBM 3740 Soft Sectored Compatible. S-100 BUS Compatible for Z-80 or 8080. Controls up to 4 Drives (single or double sided). Directly controls the following drives:
1. Shugart SA400/450 Mini Floppy
2. Shugart SA800/850 Standard Floppy.
3. PERSCI 70 and 277.
4. MFE 700/750.
5. CDC 9404/9406.
6. GSI/Siemans FDD120-8.

34 Pin Connector for Mini Floppy. 50 Pin Connector for Standard Floppy. Operates with modified CP/M operating system and C-Basic Comptier. The new "Versafloppy" from S.D. Computer Products provides complete control for many of the available Floppy Disk Drives, Both Mini and Full Size. FD1771B-1 Single Density Controller Chip. Listings for Control Software are included in price.

SAVE $100.00

DM2700S DISK & CABINET with POWER SUPPLY

DM2700S includes Siemans or Shugart Disk Drive with the following features:

SHOP & COMPARE!

- Single or Double Density
- Hard or Soft Sector
- Write Protect
- Hard Sector Detection
- 500 KB/S Transfer
- 800 KB unformated
- Bit density 6536 BP1
- Sugart 800 Series Compatable

Cabinet includes:
- 110V to 125V 60 Hz power supply
- Data Cable
- Fan
- Accepts per SCI, Shugart, Siemans 8" Drives

DM2700S Disk Drive & Cabinet **$650.00**
REG. $750 SALE PRICED

DM2700 Cabinet, less Drive ~~$249.00~~ **$225.00**

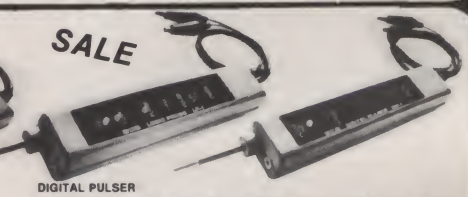
CONTINENTAL SPECIALTIES CORPORATION

CSC

Logic Probes and Digital Pulsers

SALE

SALE



LOGIC PROBES

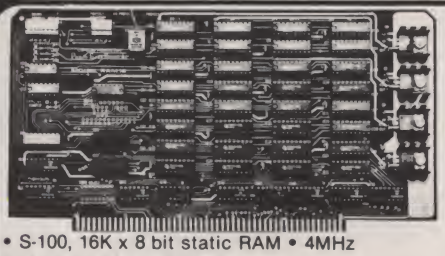
CSC logic probes are the ultimate tool for breadboard design and testing. These hand-held units provide an instant overview of circuit conditions. Simple to use; just clip power leads to circuit's power supply, set logic family switch to TTL/DTL or CMOS/HTL. Touch probe to test node. Trace logic levels and pulses through digital circuits. Even stretch and latch for easy pulse detection. Instant recognition of high, low or invalid levels, open circuits and nodes. Simple, dual-level detector LEDs tell it quickly, correctly. HI (Logic "1"); LO (Logic "0"). Also incorporates blinking pulse detector. e.g., Hi and LO LEDs blink on or off, tracking "1" or "0" states at square wave frequencies up to 1.5 MHz. Pulse LED blinks on for ½ second during pulse transition. Choice of three models to meet individual requirements; budget, project and speed of logic circuits.

MODEL LP-1
Hand-held logic probe provides instant reading of logic levels for TTL, DTL, HTL or CMOS. **Input Impedance:** 100,000 ohms. **Minimum Detectable Pulse:** 50 ns. **Maximum Input Signal (Frequency):** 10 MHz. **Pulse Detector (LED):** High speed train or single event. **Pulse Memory:** Pulse or level transition detected and stored.
CSC Model LP-1 Logic Probe—Net Each ..... ~~$44.95~~ **$42.70**

MODEL LP-2
Economy version of Model LP-1. Safer than a voltmeter. More accurate than a scope. **Input Impedance:** 300,000 ohms. **Minimum Detectable Pulse:** 300 ns. **Maximum Input Signal (Frequency):** 1.5 MHz. **Pulse Detector (LED):** High speed train or single event. **Pulse Memory:** None.
CSC Model LP-2 Logic Probe—Net Each ..... ~~$24.95~~ **$23.70**

MODEL LP-3
High speed logic probe. Captures pulses as short as 10 ns. **Input Impedance:** 500,000 ohms. **Minimum Detectable Pulse:** 10 ns. **Maximum Input Signal (Frequency):** 50 MHz. **Pulse Detector (LED):** High speed train or single event. **Pulse Memory:** Pulse or level transition detected and stored.
CSC Model LP-3 Logic Probe—Net Each ..... ~~$90.95~~ **$66.45**

DIGITAL PULSER
The ultimate in speed and ease of operation. Simply connect clip leads to positive and negative power, then touch DP-1's probe to a circuit node; automatic polarity sensor detects circuit's high or low condition. Depress the pushbutton and trigger an opposite polarity pulse into the circuit. Fast troubleshooting includes injecting signals at key points in TTL, DTL, CMOS or other popular circuits. Test with single pulse or 100 pulses per second via built-in dual control push-button; button selects single shot or continuous modes. LED indicator monitors operating modes by flashing once for single pulse or continuously for a pulse train. Completely automatic, pencil-size lab/field pulse generator for any family of digital circuits. **Output:** Tri-state. **Polarity:** Pulse-sensing auto-polarity. **Sync and Source:** 100 mA. **Pulse Train:** 100 pps. **LED Indicator:** Flashes for single pulse; stays lit for pulse train.
CSC Model DP-1 Digital Pulser—Net Each ..... ~~$74.95~~ **$71.20**



RAM 16
~~$449.00~~
SALE PRICE
$325

- S-100, 16K x 8 bit static RAM • 4MHz
- Addressable in 4K steps
- Memory protection in 1K increments, from bottom board address up or top down.
- Memory protection activated / deactivated by large, easily accessible switch.
- May deactivate up to six 1K segments of board by use of jumpers to create "holes" for other devices.
- DIP switch selectable wait states
- Phantom line DIP switch
- Bank-select for expansion beyond 65K of memory
- Schmitt trigger-buffered I/O lines
- All IC's mounted in low-profile sockets
- Assembled, tested, burned-in at factory.

Streaker Motherboard

- In 7, 12, and 22-slot versions • S-100 compatible
- Connectors have bifurcated, gold-plated contacts
- Ground plane surrounding each signal
- Compatible with Imsai chassis
- Power connections compatible with power supplies in PSS's CM4800, CM5000, and CM5200 Computer mainframes.
- Fully-assembled and tested at factory.
- No isolation hardware required for mounting.

	Bare Board	Kit with Connectors	Assembled Tested
Streaker 7	24.00	49.95	64.95
Streaker 12	29.50	64.95	89.00
Streaker 22	49.95	99.95	147.00

P21

VISA

PRIORITY ONE ELECTRONICS ©

16723K Roscoe Blvd. Sepulveda, CA 91343

MasterCharge

ORDER TODAY 1-800-423-5633

Terms: Visa, MC, BAC, Check, Money Order, C.O.D. U.S. Funds Only. CA residents add 6% sales tax. Minimum order $10.00. Prepaid U.S. orders less than $75.00 include 5% shipping and handling, minimum $2.50. Excess refunded. Just in case . . . please include your phone no.

Prices subject to change without notice.

We will do our best to maintain prices thru July 1979.

phone orders welcome (213) 894-8171, (800) 423-5633

OEM and Institutional inquiries invited.

Visit our new retail location!

HICKOK LX303 $74.95

HICKOK LX303
$74.95*

.5%, 3½ digit 19 Range DVM. ½" LCD displays runs 200 hrs on 1 battery. 10 Meg Ohm Input. 1 yr. guarantee, made in U.S.A., test leads included.

Available Accessories

RC-3 115V AC Adapter **$7.50**
CC-3 Deluxe Padded Vinyl Carrying Case **$7.50**
VP-10 X10 DCV Probe Adapter/ Protector 10Kv **$14.95**
VP-40 40Kv DC Probe **$35.00**
CS-1 10 Amp Current Shunt **$14.95**

***FREE**

Just for Asking.
FREE BATTERY with your meter.

HICKOK 1¢ Sale

DUAL-TRACE 30 MHz Oscilloscope
Model 532
Deluxe 10:1 Probe Set
SALE PRICED AT
$1145.00

WOW

Dual-Trace 30 MHz Oscilloscope

• Built in delay line for leading edge viewing of fast risetime pulses. • Compact portable size. • 11.7 ns risetime. • Full time X4 expansion (horizontal position control automatically allows moving trace 4 screen widths at all sweep times). • **TEST MOST DIGITAL LOGIC CIRCUITS INCLUDING MICROPROCESSORS.** • **STABLE TRIGGERING UP TO 50 MHz.** • High and low pass trigger filters. • 11 step precision vertical attenuators. • 24 calibrated sweep times. • Analyze CB AM and SSB waveforms. • Regulated power supplies for accuracy over 105-130 VAC.

SPECIFICATIONS

VERTICAL RANGES: 10 mV/DIV to 20 V/DIV in 11 calibrated steps. Variable control permits fine adjustment between steps. **Accuracy:** ±4%. **Frequency Response:** DC to 30 MHz (-3 dB) DC coupled, 2 Hz to 30 MHz (-3 dB) AC coupled. **Risetime:** 11.7 ns. **Overshoot:** 4% or less. **Positioning:** 3 screens. **Input Impedance:** 1 megohm ±2% shunted by 27 pF, ±1.0 pF. **Maximum Input Voltage:** 500 V DC plus peak AC except 300 volts on .01 V range. **Vertical Modes:** Channel A only; Channel B only; Alternate A & B, Chopped A & B, Difference (A-B). **TIME BASE Sweep Rates:** 2 SEC/DIV to 0.05 μ SEC/DIV in 24 calibrated steps. Variable control permits fine adjustment between steps. **Accuracy:** ±4%. Except 7% from 2 SEC/DIV to 0.5 SEC/DIV. **TRIGGERING Modes:** AC-HF High pass filter, signal component below 3 kHz rejected. AC-LF Low pass filter, signal component above 10 kHz rejected. **Auto:** Provides continuous sweep without input signal. **Sources:** Line, internal, External. **Slope:** Positive and negative; continuously variable level control. **Sensitivity:** internal, ½ division (on CRT) to 30 MHz; 1 division to 50 MHz; external, 200 mV to 5 V peak-to-peak. **EXTERNAL HORIZONTAL** (X-AXIS). **Frequency Response:** DC to 5 MHz, AC, DC coupled. **Input Impedance;** 1 megohm ±5% shunted by approximately 30 pF. **GENERAL Probe Calibrator:** 0.6 V peak-to-peak, 200 ns risetime. **CRT:** 4-inch flat faced round with viewing area of 6 x 10 divisions. **Power Requirements:** 105-125 V, 50-400 Hz, 35 watts. **SIZE & WT.:** 6-7/8" h x 11¼" w x 17¾" d, 27 pounds (not including handle). (17.2 cm x 28.6 cm x 45.1 cm) (12.27 kg). **ACCESSORIES:** Model 532 includes 2 model SP-7, 10:1 probes and instruction manual. **Includes two probes.**

LX303 DVM 1¢ with Purchase of Scope

HICKOK LX303 $74.95

- Kit includes 12 tantalum capacitors for +5, +12, −12 buses and insulated mounting spacers
- Wiring side shown. Component side bare epoxy glass with white markings for component locations
- G10 epoxy glass board with 2 ounce copper, solder plated and .038 diameter holes for leads.
- Solder mask with solder windows on etched circuits to avoid accidental short circuits
- Mounts 11 receptacles with 100 contacts (2 rows) on .125 centers with .250 row spacing. Vector part number R681-2, or mounts 10 receptacles plus interconnections to smaller mother board for expansion
- Includes etched circuits and instructions for option of active, pull-up, or floating terminations
- Large buses +5V and GND (10 AMPS), ±12V or 16V (7 AMPS) Current ratings are per MIL-STD-275 with 10ºC rise
- Fits in Vector-pak enclosures
- Fits in IMSAI 8080 microcomputer as expander board

8803 MOTHER BOARD FOR S100 BUS MICRO-COMPUTERS

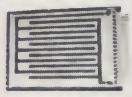
Vector

Price: $29.50

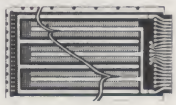
Vector **Plugboards**

8800V
Universal Microcomputer/processor plugboard. use with S-100 bus Complete with heat sink & hardware 5.3" x 10" x 1/16"
1-4 $19.95 | 5-9 $17.95 | 10-24 $15.96

8801-1
Same as 8800V except plain, less power buses & heat sink
1-4 $15.22 | 5-9 $13.79 | 10-24 $12.18

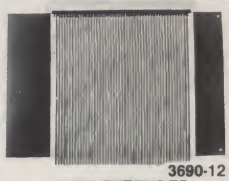


3682 9.6" x 4.5" $10.97
3682-2 6.5" x 4.5" $9.81
Hi-Density Dual-In-Line Plugboard for Wire Wrap with Power & Grd. Bus Epoxy Glass 1/16" 44 pin con. spaced .156



3677 9 6" x 4.5" $10.90
3677-2 6.5" x 4.5" $9.74
Gen. Purpose D.I.P. Boards with Bus Pattern for Solder or Wire Wrap. Epoxy Glass 1/16" 44 pin con. spaced .156

3662 6.5" x 4.5" $7.65
3662-2 9.6" x 4.5" $11.45
P pattern plugboards for IC's Epoxy Glass 1/16" 44 pin con. spaced .156



3690-12 CARD EXTENDER
Card Extender has 100 contacts 50 per side on .125 centers-Attached connector-is compatible with S-100 Bus Systems. **$25.83**
3690 6.5" 22/44 pin .156 ctrs. Extenders $13.17

HICKOK LX303 $74.95

1/16 Vector BOARD
.042 dia holes on 0.1 spacing for IC's

Phenolic PART NO.	SIZE	PRICE 1-9	10-19
64P44XXXP	4.5x6.5"	$1.56	$1.40
169P44XXXP	4.5x17"	$3.69	$3.32
Epoxy Glass			
64P44	4.5x6.5"	$1.79	$1.61
84P44	4.5x8.5"	$2.21	$1.99
169P44	4.5x17"	$4.52	$4.07
169P84	8.5x17"	$8.03	$7.23

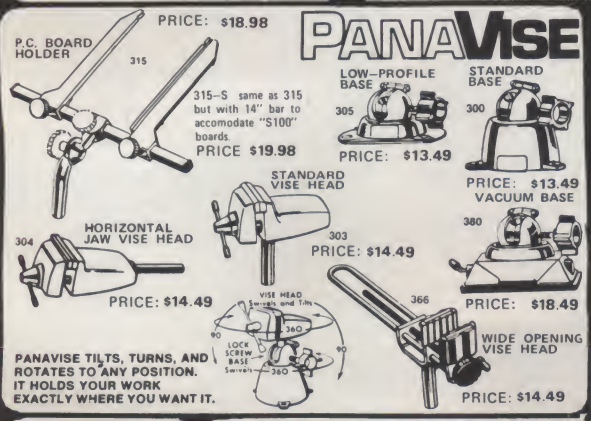
TRS-80/APPLE
MEMORY EXPANSION KITS
4116's RAMS
from Leading Manufacturers
(16Kx1 200ns)
8 for $75.00
Add $3.00 for programming Jumpers for TRS-80 Keyboard

2708
8K 450 ns
EPROM
FACTORY PRIME
$10.00 EA
25 + *Call For Price*

WOW

14 & 16 PIN GOLD 3 LEVEL WIRE WRAP SOCKETS
14 - G3 100 for **$30.00**
16-G3 100 for **$30.00**
50 of each for **$32.00**
Sockets are End & Side stackable, closed entry

HICKOK LX303 $74.95



2114N-L
4096 - BIT (1024x4) 450 ns Low Power Static Ram
8 for $50.00

ORDER TOLL FREE
1-800-423-5633
except CA., AK., HI., Call
(213) 894-8171

HICKOK LX303 $74.95

2102LPC
450ns Low Power RAMS
$1.10 Ea. in lots of 25
2102LHPC
250ns Low Power RAMS
$1.25 Ea. in lots of 25

TMS 4044/ MM 5257-3L
4096x1 300 ns Low Power Static Ram
8 for $50.00

Vector
WRAP POST
for .042 dia. holes
(all boards on this page)
T44/C pkg. 100 .. **$ 2.34**
T44/M pkg. 1000 ..... **$14.35**
A-13 hand installing tool ..... **$ 2.94**

VISA

PRIORITY ONE ELECTRONICS ©
16723K Roscoe Blvd. Sepulveda, CA 91343
Terms: Visa, MC, BAC, Check, Money Order, C.O.D. U.S. Funds Only. CA residents add 6% sales tax. Minimum order $10.00. Prepaid U.S. orders less than $75.00 include 5% shipping and handling, minimum $2.50. Excess refunded. Just in case . . . please include your phone no.
Prices subject to change without notice.
We will do our best to maintain prices thru July 1979.
phone orders welcome (213) 894-8171, (800) 423-5633
OEM and Institutional Inquiries invited.

2716
5 volt only
16K EPROM
$50.00

HICKOK LX303 $74.95

DIODES/ZENERS

QTY.				
	1N914	100v	10mA	.05
	1N4005	600v	1A	.08
	1N4007	1000v	1A	.15
	1N4148	75v	10mA	.05
	1N4733	5.1v	1 W Zenner	.25
	1N4749	24v	1W	.25
	1N753A	6.2v	500 mW Zener	.25
	1N758A	10v	"	.25
	1N759A	12v	"	.25
	1N5243	13v	"	.25
	1N5244B	14v	"	.25
	1N5245B	15v	"	.25
	1N5349	12v	3W	.25

SOCKETS/BRIDGES

QTY.					
	8-pin	pcb	.16	ww	.35
	14-pin	pcb	.20	ww	.40
	16-pin	pcb	.25	ww	.45
	18-pin	pcb	.30	ww	.95
	20-pin	pcb	.35	ww	1.05
	22-pin	pcb	.40	ww	1.15
	24-pin	pcb	.45	ww	1.25
	28-pin	pcb	.50	ww	1.35
	40-pin	pcb	.55	ww	1.45
	Molex pins	.01	To-3 Sockets		.35
	2 Amp Bridge		100-prv		.95
	25 Amp Bridge		200-prv		1.50

TRANSISTORS, LEDS, etc.

QTY.			
	2N2222M	(2N2222 Plastic .10)	.15
	2N2222A		.19
	2N2907A	PNP	.19
	2N3906	PNP (Plastic)	.19
	2N3904	NPN (Plastic)	.19
	2N3054	NPN	.55
	2N3055	NPN 15A 60v	.60
	T1P125	PNP Darlington	1.95
	LED Green,	Red, Clear, Yellow	.19
	D.L.747	7 seg 5/8" High com-anode	1.95
	MAN72	7 seg com-anode (Red)	1.25
	MAN3610	7 seg com-anode (Orange)	1.25
	MAN82A	7 seg com-anode (Yellow)	1.25
	MAN74	7 seg com-cathode (Red)	1.50
	FND359	7 seg com-cathode (Red)	1.25

9000 SERIES

QTY.		QTY.	
9301	.85	9322	.65
9309	.50	9601	.30
		9602	.45

MICRO's, RAMS, CPU's, E-PROMS

QTY.	
8T13	2.50
8T23	2.50
8T24	3.00
8T97	1.75
74S188	3.00
1488	1.25
1489	1.25
1702A	4.50
AM 9050	4.00
ICM 7207	6.95
ICM 7208	13.95
MPS 6520	10.00
MM 5314	4.00
MM 5316	4.50
MM 5387	3.50
MM 5369	2.95
TR 1602B	3.95
UPD 414	4.95
Z 80 A	22.50
Z 80	17.50
Z 80 P10	10.50
2102	1.45
2102L	1.75
2107B-4	4.95
2114	9.50
2513	6.25
2708	11.50
2716 D.S.	34.00
2716 (5v)	69.00
2758 (5v)	26.95
3242	10.50
4116	11.50
6800	13.95
6850	7.95
8080	7.50
8085	22.50
8212	2.75
8214	4.95
8216	3.50
8224	4.25
8228	6.00
8251	7.50
8253	18.50
8255	8.50
TMS 4044	9.95

C MOS

QTY.		QTY.		QTY.		QTY.	
4000	.15	4017	.75	4034	2.45	4069/74C04	.45
4001	.20	4018	.75	4035	.75	4071	.25
4002	.25	4019	.35	4037	1.80	4081	.30
4004	3.95	4020	.85	4040	.75	4082	.30
4006	.95	4021	.75	4041	.69	4507	.95
4007	.25	4022	.75	4042	.65	4511	.95
4008	.75	4023	.25	4043	.50	4512	1.50
4009	.35	4024	.75	4044	.65	4515	2.95
4010	.35	4025	.25	4046	1.25	4519	.85
4011	.30	4026	1.95	4047	2.50	4522	1.10
4012	.25	4027	.35	4048	1.25	4526	.95
4013	.40	4028	.75	4049	.65	4528	1.10
4014	.75	4029	1.15	4050	.45	4529	.95
4015	.75	4030	.30	4052	.75	MC14409	14.50
4016	.35	4033	1.50	4053	.95	MC14419	4.85
				4066	.75	74C151	2.50

– T T L –

4-1-79

QTY.		QTY.		QTY.		QTY.	
7400	.20	7492	.45	74H20	.25	74LS76	.70
7401	.20	7493	.35	74H21	.25	74LS86	.95
7402	.20	7494	.75	74H22	.40	74LS90	.85
7403	.20	7495	.60	74H30	.30	74LS93	.85
7404	.20	7496	.80	74H40	.35	74LS96	2.00
7405	.35	74100	1.15	74H50	.30	74LS107	.90
7406	.25	74107	.35	74H51	.30	74LS109	1.50
7407	.55	74121	.35	74H52	.20	74LS123	1.95
7408	.20	74122	.55	74H53	.25	74LS138	2.00
7409	.25	74123	.55	74H55	.25	74LS151	.95
7410	.20	74125	.45	74H72	.35	74LS153	1.15
7411	.25	74126	.45	74H74	.35	74LS157	1.15
7412	.25	74132	.75	74H101	.95	74LS160	1.15
7413	.45	74141	.90	74H103	.55	74LS164	2.90
7414	.75	74150	.85	74H106	1.15	74LS193	2.00
7416	.25	74151	.95	74L00	.30	74LS195	1.15
7417	.40	74153	.95	74L02	.30	74LS244	2.90
7420	.25	74154	1.15	74L03	.35	74LS259	1.50
7426	.25	74156	.70	74L04	.40	74LS298	1.50
7427	.25	74157	.65	74L10	.30	74LS367	1.95
7430	.20	74161/9316	.75	74L20	.45	74LS368	1.25
7432	.30	74163	.85	74L30	.55	74LS373	2.50
7437	.20	74164	.75	74L47	1.95	74S00	.45
7438	.30	74165	1.10	74L51	.65	74S02	.45
7440	.20	74166	1.75	74L55	.85	74S03	.35
7441	1.15	74175	.90	74L72	.65	74S04	.35
7442	.55	74176	.95	74L73	.70	74S05	.45
7443	.45	74177	1.10	74L74	.75	74S08	.45
7444	.45	74180	.95	74L75	1.05	74S10	.45
7445	.75	74181	2.25	74L85	2.00	74S11	.45
7446	.70	74182	.75	74L93	.75	74S20	.35
7447	.70	74190	1.25	74L123	1.95	74S22	.55
7448	.50	74191	2.25	74LS00	.40	74S40	.30
7450	.25	74192	.75	74LS01	.40	74S50	.30
7451	.25	74193	.85	74LS02	.45	74S51	.35
7453	.20	74194	.95	74LS03	.45	74S64	.15
7454	.25	74195	.95	74LS04	.45	74S74	.70
7460	.40	74196	.95	74LS05	.45	74S112	.60
7470	.45	74197	.95	74LS08	.45	74S114	.85
7472	.40	74198	1.45	74LS09	.45	74S133	.85
7473	.25	74221	1.50	74LS10	.45	74S140	.75
7474	.30	74298	1.50	74LS11	.45	74S151	.95
7475	.35	74367	1.35	74LS20	.45	74S153	.95
7476	.40	75491	.65	74LS21	.45	74S157	.98
7480	.75	75492	.65	74LS22	.45	74S158	.80
7481	.85	74H00	.20	74LS32	.50	74S194	1.50
7482	.95	74H01	.30	74LS37	.45	74S196	2.00
7483	.95	74H04	.30	74LS38	.65	74S257 (8123)	2.50
7485	.75	74H05	.25	74LS40	.70	8131	2.75
7486	.55	74H08	.35	74LS42	.95		
7489	1.05	74H10	.35	74LS51	.75		
7490	.55	74H11	.25	74LS74	.95		
7491	.70	74H15	.45	74LS75	1.20		

I^2L, LINEARS, REGULATORS, ETC.

QTY.		QTY.		QTY.	
MCT2	.95	LM320K24	1.65	LM373	3.95
8038	3.95	LM320T5	1.65	LM377	3.95
LM201	.75	LM320T12	1.65	78L05	.75
LM301	.45	LM320T15	1.65	78L12	.75
LM308	.65	LM323K	5.95	78L15	.75
LM309H	.85	LM324	1.25	78M05	.75
LM309 (340K-5)	1.50	LM339	.75	LM380 (8-14 Pin)	1.19
LM310	.85	7805 (340T5)	1.15	LM709 (8-14 Pin)	.45
LM311 (8-14 Pin)	.75	LM340T12	.95	LM711	.45
LM318	1.50	LM340T15	.95	LM723	.40
LM320H6	.79	LM340T18	.95	LM725	2.50
LM320H15	.79	LM340T24	.95	LM739	1.50
LM320H24	.79	LM340K12	1.25	LM741 (8-14)	.45
7905 (LM320K5)	1.65	LM340K15	1.25	LM747	1.10
LM320K12	1.65	LM340K18	1.25	LM1307	1.75
LM320K15	1.65	LM340K24	1.25	LM1458	.65
				LM3900	.95
				LM75451	.65
				NE555	.45
				NE556	.85
				NE565	1.15
				NE566	1.25
				NE567	.95
				TA7205	6.95
				76477	2.95
				95H90	9.95

INTEGRATED CIRCUITS UNLIMITED

7889 Clairemont Mesa Blvd., San Diego, California 92111
Out of State 1-800-854-2211 **Cable Address:ICUSD** **Telex: 697-827**
(714) 278-4394 **California Residents** **1-800-542-6239**

NAME _____

STREET ADDRESS _____

CITY _____ STATE _____ ZIP _____

PHONE _____ CHARGE CARD # AE Visa BA MC _____ EXP. DATE _____

C.O.D. _____ WILL CALL _____ UPS _____ POST _____ NET 10th OF THE MONTH _____ PO # _____

ALL ORDERS SHIPPED PREPAID – NO MINIMUM – COD ORDERS ACCEPTED – ALL ORDERS SHIPPED SAME DAY
OPEN ACCOUNTS INVITED – California Residents add 6% Sales Tax. PRICES SUBJECT TO CHANGE WITHOUT NOTICE.
24 Hour Phone Service – We accept American Express / Visa / BankAmericard / Master Charge

SPECIAL DISCOUNTS

Total Order	Deduct
$35-$99	10%
$100-$300	15%
$301-$1000	20%

Here's the LATEST news...

We're expanding again! **CompuKit** is now **CompuPro** to reflect the fact that more and more of our production is being devoted to non-kit products . . . not only is there increased demand for our standard **assembled & tested** models, but the high-reliability **Certified System Component** boards (with 200 hour burn-in and immediate replacement in event of failure within 1 year of invoice date) are really taking off. Kit builders need not fear, however; when economy is paramount, most **CompuPro** products are also available in **"unkit"** form (sockets, bypass caps presoldered in place). All of this is part of our continuing commitment to provide the best possible products at the lowest possible prices . . . the same commitment responsible for making us an industry leader in the first place.

THE ECONORAM* MEMORY LINE:

LOW POWER AND LOW PRICE MEET HIGH TECHNOLOGY

Name	Storage	Buss	Speed	Technology	Configuration	Unkit	Assm	CSC
Econoram IIA	8K X 8	S-100	4 MHz	static	2-4K blocks	**$149**	**$179**	**$239**
Econoram IV	16K X 8	S-100	4 MHz	static	1-16K	**$295**	**$329**	**$429**
Econoram VI	12K X 8	H8	2 MHz	static	1-8K, 1-4K	**$200**	**$270**	N/A
Econoram VII	24K X 8	S-100	4 MHz	static	2-4K, 2-8K	**$445**	**$485**	**$605**
Econoram IX	32K X 8	Dig Grp	4 MHz	static	2-4K, 1-8K, 1-16K	**$559**	**$639**	N/A
Econoram X	32K X 8	S-100	4 MHz	static	2-8K, 1-16K	**$599**	**$649**	**$789**
Econoram XI	32K X 8	SBC	4 MHz	static	2-8K, 1-16K	N/A	N/A	**$1050**

BANK SELECT MEMORIES (for Alpha Micro Systems, Marinchip, etc.)

Econoram XII-16	16K X 8	S-100	4 MHz	static	2 indep. banks**	**$369**	**$419**	**$ 519**
Econoram XII-24	24K X 8	S-100	4 MHz	static	2 indep. banks**	**$479**	**$539**	**$ 649**
Econoram XIII	32K X 8	S-100	4 MHz	static	2 indep. banks**	**$629**	**$699**	**$ 849**

*Econoram is a trademark of Bill Godbout Electronics
**Econoram XII-16 and -24 have 2 independent banks addressable on 8K boundaries; Econoram XIII has 2 independent banks addressable on 16K boundaries.

SPECIAL SUMMER SALE: 16K MEMORY EXPANSION CHIP SET ~~$109~~ $87.20

20% off one of our all-time best sellers from July 15 to August 31 **only.** For **Radio Shack-80, Exidy Sorcerer, Apple** computers. 250 ns access time, **low** power parts, DIP shunts included, 1 year limited warranty, and easy-to-follow instructions that make memory expansion a snap.

S-100 MOTHERBOARD

18 slot unkit: $124. Each motherboard includes all edge connectors wave-soldered in place for easy assembly, integral active termination circuitry, extra wide power and ground traces, and much more.

ACTIVE TERMINATOR KIT $34.50

As written up by Craig Anderton in the April '79 issue of **Kilobaud Microcomputing.** Our much imitated design plugs into any S-100 motherboard to reduce ringing, crosstalk, noise, and other buss-related problems.

H8 EXTENDER BOARD KIT $39

New from **Mullen Computer Products.** Really takes the hassle out of troubleshooting or testing the popular Heath H8 microcomputer; includes jumper links in the power supply lines for insertion of fuses, Ammeters, current limiters, and the like.

S-100 EXTENDER BOARD KIT $39

From **Mullen Computer Products.** Includes jumper links in supply lines, on board logic probe, and general purpose "kluge board" area for installing custom testing jigs or other circuits.

DUAL CHANNEL/DUAL FUNCTION S-100 I/O BOARD $189 unkit, $249 assm.

This board does things the others only dream about. Features **two** independently addressable serial ports with full RS232C, current loop (20 mA) and TTL signals on both ports. Includes on board xtal timebase and Baud rate generator for Baud rates up to 19.2 KBaud, EIA 232C receivers and drivers (1488, 1489), hardware LSI UARTs that don't tie up the computer's CPU, operation with 2 or 4 MHz systems, software programmable UART parameters/interupt enables/handshaking lines (handshaking lines are full RS232 — not just a 3 wire system), optically isolated current loop, provision for custom frequency compensation on both receive and transmit sides to accommodate varying speed/noise situations or unusual cable lengths . . . and even all this isn't the full story of what this board can do for you. See it in person at a computer store near you, or order direct from us.

2708 EROM BOARD "UNKIT" $85

4 independently addressable 4K blocks, with selective disable for each block. Built to **CompuPro/Econoram** standards (dipswitch addressing, top quality board, sockets wave-soldered in place), and includes dipswitch selectable jump start built right into the board. Includes all support chips and manual, but does **not** include EROMs. **Special: if you order before August 1st, our introductory price of $69.95 is still in effect.** Orders postmarked August 1st or later are no longer eligible for the introductory price . . . no exceptions.

POPULAR COMPUTER ICs

Low power **21L02** static 1K RAMs on special: **10/$9.90** (under 1¢ per **byte!**) **1791 MOS LSI** dual density disc controller from Western Digital: **$59** with pinout and data. **1771** single density controller: **$22.50.** All parts are offered on a while-they-last basis.

We realize that it is becoming less and less common for manufacturers to offer their products in kit form, so we'd like to emphasize that we are **not** planning to phase out our kits. The "hackers" who derive enjoyment from building and testing equipment themselves were our very first customers, and we recognize that these experimentally-minded individuals have been responsible for many significant developments in the microcomputer field. As long as people want to put things together with their very own hands, we'll continue to offer kits . . . and continue to repair them promptly under the terms of our 1 year limited warranty (almost always without charge), in the rare event that a problem occurs.

TERMS: Cal. res. add tax. Allow 5% shipping, excess refunded. Orders under $15 add $1 handling. VISA® /Mastercharge® call our 24 hour order desk at **(415) 562-0636.** COD OK with street address for UPS. Prices good through cover month of magazine except as noted.

CompuPro™ from GODBOUT ELECTRONICS

Box 2355, Oakland Airport, CA 94614

✓G4

FREE FLYER: We'll be glad to tell you more than the space of this ad permits. Just send your name and address, we'll take care of the rest. If you're in a hurry, enclose 41¢ in stamps for 1st class delivery.

✓ Reader Service—see page 179

New dealership program!

HOUSTON MICRO-COMPUTER TECHNOLOGIES INC. is proud to announce its new dealership program through authorized Radio Shack Dealers and Franchisees around the country.

All Radio Shacks are not created equall There are several good reasons you should buy your TRS-80* from an independent Radio Shack Dealer or Franchisee. Most Radio Shack outlets are company-owned and are tightly restricted in what products and services they can offer you. However, there are over 2,000 independent Radio Shack Dealers around the country — more and more of whom are becoming affiliated with Houston Micro-Computer Technologies — who can offer you a wider range of product, better service, quicker delivery, and more thorough follow-up than the Radio Shack company stores can hope to provide.

Radio Shack company stores can only demonstrate and sell Radio Shack products, whereas our network of independent Radio Shack distributors can offer you a wide range of high quality products. Comparative delivery dates are worlds apart! For instance, Radio Shack company stores advertise a 4 to 5 month delivery on disk drives; our dealers can procure disk drives from us in 30 days! If a Radio Shack dosen't have what you need: tough bananas! Yet our Radio Shack dealers can get what you need from us, even if it means our writing a special program for you.

It is important to remember that our dealers are independent businessmen who have been in your community for some time and have a real stake in your satisfaction. And rest assured that all Radio Shack products sold by Dealers and Franchisees are completely warranteed by Radio Shack, and that all other brands we handle are completely guaranteed by the manufacturer and by us.

Houston Micro-Computer Technologies has a team of highly trained computer specialists with over 37 years of experience in the Radio Shack organization. We specialize in the TRS-80*— the world's most popular microcomputer — but also offer, through our extensive network of independent Radio Shack dealers, a complete computer product line which includes the complete *Centronics* line of printers, *Texas Instruments'* outstanding 810 and 820 (KSR) line printers, *Pertec* disk drives, *NEC Spinwriter, IBM* Selectraprint, *Scotch* diskettes, and *NEC RAM kits.* More powerful computer systems will also soon be available through Houston Micro-Computer Technologies' dealer network.

Please call or write Houston Micro-Computer Technologies Inc. today and let us give you the name and address of the nearest authorized independent Radio Shack distributor who can offer you the full range of products, services, and expertise that you require.

*TRS-80 is a product of Radio Shack

TRS · 80 TRS · 80 TRS · 80 TRS · 80 TRS · 80 TRS · 80 TRS · 80 TRS · 80 TRS · 80

Security Analysis Package

- annuities calculation
- stock valuation
- option value
- option writing
- capital accumulation planning
- and much more

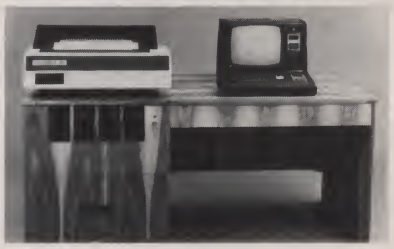
32K Disk System Required

Software Technical Manual

This manual gives all the calling addresses of the functions and keywords in the Level II BASIC. It also explains internal data manipulation, compare logic, in-memory formats, and much more.

Manual	49.95
Disassembler	19.95
Both	59.95

Surveying Package



Performs the following:

- traversing by angles or points
- closure and adjustment of angle
- traverse balancing
- mathematical functions
  - rotated traverse
  - geometric problem solving
- and much more

32K Disk System Required

To order by phone or for local dealer information call: **713/661-2005**
Texas residents add 6% sales tax • MasterCharge • Visa

HOUSTON MICRO-COMPUTER TECHNOLOGIES, INC.

✓H45

Home and Business Computer Specialists

5313 BISSONNET • BELLAIRE • TEXAS • 77401 • 713/661-2005

✓ Reader Service—see page 179

We have 5V 2716's in Stock. We have the Best Prices on 2102's, 2114's, 4116's.

We make Custom Ribbon Cable Assemblies while you wait! We have the Best Prices on 2102's, 2114's, 4116's.

S-100 BUS EDGE CONNECTORS

S100-WWG 50/100 Cont. .125 ctrs. 3 LEVEL WIRE WRAP .025" sq. posts on 250 spaced rows. GOLD PLATED.

1-4	5-9	10-24
$4.00	$3.75	$3.50

S100-STG 50/100 Cont. .125 ctrs. DIP SOLDER TAIL on 250 spaced rows for VECTOR and MASI motherboards GOLD plated.

1-4	5-9	10-24
$3.50	$3.25	$3.00

S100ALT 50/100 Cont. .125 ctrs. DIP SOLDER TAIL on .140 spaced rows for ALTAIR motherboards. GOLD plated.

1-4	5-9	10-24
$4.00	$3.75	$3.50

S100SE 50/100 Cont. .125 ctrs. PIERCED SOLDER EYELET tails. GOLD

1-4	5-9	10-24
$5.00	$4.50	$4.25

OTHER POPULAR EDGE CONNECTORS

All Edge Card Connectors are GOLD PLATED (not Gold Flash) Bodies are non brittle, Solvent res., G.E. Valox. Contacts are Bifurcated; Phos/Bronze: GOLD over Nickel.

ABBREVIATIONS: SE = Solder Eyelet WW = 3 Level Wire Wrap ST = Solder Tail

.100" Contact Center Connectors

PART NO.	TYPICAL APPLICATION	PRICE 1-4	5-9	10-24
D1326-1SE	Imsai M10, SIO	2.60	2.40	2.20
D2244-1WW	Vector Plugboards	4.00	3.80	3.60
D2550-1SE	Imsai P10, Intel Multibuss	3.70	3.50	3.40
D2550-1ST	Imsai P10, Intel Multibuss	3.50	3.30	3.10
D2040-1SE	TRS-80	3.20	3.05	2.90
D2040-1ST	TRS-80	3.00	2.85	2.70
D2040-1WW	TRS-80	3.30	3.15	3.00
D3060-1WW	Intel Multibuss	4.10	3.90	3.70
D3672-1SE	Vector Plugboards	5.00	4.75	4.50
D3672-1ST	Vector Plugboards	4.95	4.70	4.45
D3672-1WW	Vector Plugboards	4.90	4.65	4.40
D4080-1SE	PET	5.95	5.70	5.45
D4080-1ST	PET	5.00	4.75	4.50
D4080-1WW	PET	5.20	4.95	4.70
D4386-1SE	Cos. ELF	5.60	5.35	5.05
D4386-1ST	Cos. ELF	5.40	5.15	4.90
D4386-1WW	Cos. ELF	5.50	5.25	5.00
D50100-1WW		5.95	5.75	5.55

.125" Contact Center Connectors

PART NO.	TYPICAL APPLICATION	PRICE 1-4	5-9	10-24
D3672-2WW		5.25	5.00	4.75
D4080-2WW	Vector 4350	5.95	5.65	5.35
S100-STG	S-100, Imsai, Vactor, Cromenco, Motherboards	3.50	3.25	3.00
S100-WWG	S-100 Wire Wrap	4.00	3.75	3.40
S100-ALT	Altair	4.50	4.25	4.00
S100SE	S100 Soldar Eyelet	5.00	4.50	4.00

.156 Contact Centers Connectors

PART NO.	TYPICAL APPLICATION	PRICE 1-4	5-9	10-24
S6X-5SE	Pet, NSC CLK Modules	1.40	1.30	1.20
D612-5SE	Pet, NSC CLK Modules	1.60	1.50	1.40
D1224-5SE	Pet	2.40	2.30	2.20
D2224-5ST	Pet	2.30	2.20	2.10
D1530-5SE	Vector Plugboards, GRI Keybrds	2.50	2.35	2.10
D1530-5ST	Vector Plugboards, GRI Keybrds	2.40	2.25	2.05
D1530-5WW	Vector Plugboards, GRI Keybrds	2.60	2.40	2.15
D1836-5SE		3.00	2.80	2.60
D2244-5SE	Vector, Kim, etc.	3.00	2.60	2.20
D2244-5ST	Vector, Kim, etc.	3.00	2.80	2.50
D2244-5WW	Vector, Kim, etc.	3.95	3.70	3.40
D3672-5SE	Vector Plugboards	5.50	5.30	5.00
D3672-5ST	Vector Plugboards	5.45	5.25	5.00
D3672-5WW	Vector Plugboards	5.60	5.40	5.10
D4386-5SE	Mot 6800, Intel Multibuss, NSC pacer	6.00	5.75	5.25
D4386-5ST	Mot 6800, Intel Multibuss, NSC pacer	5.90	5.65	5.15
D4386-5WW	Mot 6800, Intel Multibuss, NSC pacer	6.50	6.30	5.90
CG-1	Imsai Style Card Guides	5/1.00 or 100/10.00		

RS232 & "D" TYPE CONNECTORS

P = Plug-Male S = Socket-Female C = Cover-Hood

PART NO.	DESCRIPTION	PRICE 1-4	5-9	10-24
DE-9P	9 Pin Male	1.50	1.30	1.10
DE-9S	9 Pin Female	1.95	1.75	1.45
DE-9C	9 Pin Cover	1.50	1.30	1.10
DA15P	15 Pin Male	2.00	1.80	1.55
DA15S	15 Pin Female	2.90	2.70	2.45
DA15C	15 Pin Cover	1.80	1.60	1.30
DB-25P	25 Pin Male	2.50	2.20	2.05
DB-25S	25 Pin Female	3.50	3.10	2.95
DB51212-1	1 pc. Grey Hood	1.65	1.35	1.20
DB1226-1A	2 pc. Black Hood	1.80	1.50	1.35
DB110963-3	2 pc. Gray Hood	1.70	1.40	1.25
DC37P	37 Pin Male	3.95	3.75	3.50
DC37S	37 Pin Female	5.50	5.25	4.90
DC37C	37 Pin Cover	2.00	1.80	1.60
DD50P	50 Pin Male	5.00	4.75	4.60
DD50S	50 Pin Female	6.50	6.00	5.75
DD50C	50 Pin Cover	2.50	2.30	2.20
D20418-S	Hardware Set (2 pair)	1.00	.80	.70

Connector for CENTRONICS 700 SERIES:
Amphenol 57-30360 for back of Centronics 700 Series printers 1-4—$9.00 5-up—$7.50

DIP PLUGS

Part #	No. of Pins	PRICE 1-24	25-99	100-499	Part #	No. of Pins	PRICE 1-24	25-99	100-499
P08P02	8	.41	.36	.29	P22P02	22	.75	.67	.63
P14P02	14	.48	.42	.34	P24P02	24	.79	.71	.66
P16P02	16	.55	.47	.38	P28P02	28	1.10	.93	.81
P18P02	18	.67	.57	.46	P40P02	40	1.25	1.07	.94

GOLD SOLDERTAIL STANDARD IC Sockets

	1-24	25-49	50-99		1-24	25-49	50-99
8STG	.30	.27	.24	22STG	.70	.63	.57
14SG	.35	.32	.29	24STG	.70	.63	.57
16STG	.38	.35	.32	28STG	1.10	1.00	.90
18STG	.52	.47	.43	40STG	1.75	1.55	1.45
20STG	.60	.56	.52				

TIN SOLDERTAIL - LOW PROFILE IC Sockets

	1-24	25-49	50-99		1-24	25-49	50-99
8CS2	.25	.16	.15	22CS2	.37	.36	.35
14CS2	.25	.18	.16	24CS2	.38	.37	.36
16CS2	.25	.20	.18	28CS2	.45	.44	.43
18CS2	.29	.28	.27	40CS2	.63	.62	.61
20CS2	.34	.32	.30				

3 LEVEL GOLD WIRE WRAP SOCKETS

Sockets purchased in multiples of 50 per type may be combined for best price.

	1-9	10-24	25-99	100-249	250-999
8 pin*	.40	.36	.34	.31	.27
14 pin*	.45	.39	.37	.34	.32
16 pin*	.50	.42	.40	.36	.34
18 pin	.70	.60	.55	.50	.45
20 pin	.90	.80	.75	.65	.62
22 pin*	.95	.85	.80	.70	.65
24 pin	.95	.85	.80	.70	.65
28 pin	1.25	1.15	1.00	.95	.90
40 pin	1.65	1.45	1.35	1.20	1.10

All sockets are GOLD 3 level closed entry *End and side stacable 2 level. Solder Tail, Low Profile, Tin Sockets and Dip Plugs available CALL FOR QUOTATION

July Clearance SALE

PORTABLE OSCILLOSCOPES

MS-215 Dual Trace
Reg. $435.00
Sale Priced
$389.00*

MS-15 Single Trace
Reg. $318.00
Sale Priced
$289.00*

With Rechargeable Batteries and Charger Unit

- 15 megahertz band width
- External and internal trigger
- Time base - 1 micro sec. to 0.5 sec/div. 21 settings
- Battery or line operation
- Viewing area 1.1" x 1.35" case size 2.75"H x 6.4"W x 7.5"D
- Parts & labor guaranteed 1 year, made in USA!
- Automatic or line sync modes
- Power consumption less than 15W.
- Verticle Gain - 0.01 to 50 Volts/ div. 12 settings.
- Weight is only 3 pounds

41-140 Leather Carrying Case **$45.00**
41-141 10:1 Probe **$27.00**
41-3495 10:1, 1:1 Combo Probe **$36.00**

* Sale Prices Valid for PREPAID or CREDIT CARD, ORDERS ONLY.

Why Cut?
Why Strip?
Why Slit?
WHY NOT . . .

JUST WRAP ™ NEW

- AWG 30 Wire
- .025" Square Posts
- Daisy Chain or Point To Point
- Built In Cut off
- Easy Loading of Wire
- Available Wire Colors: Blue, White, Red & Yellow
- No Stripping or Slitting Required . . . JUST WRAP TM . . .

JUST WRAP TOOL WITH ONE 50 FT. ROLL OF WIRE

COLOR	PART NO.	U.S. LIST PRICE
BLUE	JW-1-B	14.95
WHITE	JW-1-W	14.95
YELLOW	JW-1-Y	14.95
RED	JW-1-R	14.95

REPLACEMENT ROLL OF WIRE 50 FT.

BLUE	R-JW-B	2.98
WHITE	R-JW-W	2.98
YELLOW	R-JW-Y	2.98
RED	R-JW-R	2.98

JUST WRAP KIT CONTAINS

- JUST WRAP Tool
- Roll of Blue Wire, 50 ft.
- Roll of White Wire, 50 ft.
- Roll of Yellow Wire, 50 ft.
- Roll of Red Wire, 50 ft.
- Unwrapping Tool

JWK-6, JUST WRAP KIT $24.95

DIP JUMPERS

FLAT RIBBON CABLE ASSEMBLIES WITH DIP CONNECTORS

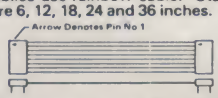
- **Available with 14, 16, 24 and 40 contacts.**
- **Mate with standard IC sockets.**
- **Fully assembled and tested.**
- **Integral molded-on strain relief.**
- **Line-by-line probeability.**

A P DIP Jumpers are the low-cost, high-quality solution for jumpering within a PC board; interconnecting between PC boards, backplanes and motherboards; interfacing Input/Output signals; and more.

All assemblies use rainbow cable. Standard lengths are 6, 12, 18, 24 and 36 inches.

WOW

DOUBLE-ENDED DIP JUMPERS



No. Contacts	Length 6"	Length 12"	Length 18"	Length 24"	Length 36"
14	924106-6-R $2.41	924106-12-R $2.61	924106-18-R $2.82	924106-24-R $3.02	924106-36-R $3.43
16	924116-6-R $2.65	924116-12-R $2.88	924116-18-R $3.11	924116-24-R $3.34	924116-36-R $3.80
24	924126-6-R $4.15	924126-12-R $4.50	924126-18-R $4.85	924126-24-R $5.20	924126-36-R $5.90
40	924136-6-R $6.93	924136-12-R $7.52	924136-18-R $8.11	924136-24-R $8.70	924136-36-R $9.88

ORDER TODAY 1-800-423-5633

P21 **PRIORITY ONE ELECTRONICS** ©
16723K Roscoe Blvd. Sepulveda, CA 91343

Terms: Visa, MC, BAC, Check, Money Order, C.O.D. U.S. Funds Only. CA residents add 6% sales tax. Minimum order $10.00. Prepaid U.S. orders less than $75.00 include 5% shipping and handling, minimum $2.50. Excess refunded. Just in case . . . please include your phone no.

Prices subject to change without notice. **OEM and Institutional inquiries invited.**

We will do our best to maintain prices thru July 1979.

phone orders welcome (213) 894-8171, (800) 423-5633

We make Custom Ribbon Cable Assemblies while you wait! We have the Best Prices on 2102's, 2114'2, 4116's.

We have the Best Prices on 2102's, 2114's, 4116's. We have 5V 2716's in Stock.

HOBBY WORLD®

CALL TOLL FREE: (800) 423-5387
CA, HI, AK: (213) 886-9200

Your No.1 Source for Computer Electronics

Computer Boards

CCS = California Computer Systems
WMC = Wameco
IA = Ithaca Audio
SSM = Solid State Music
SDS = SD Systems
SPL = Speechlab
HUH = HUH Electronics
MH = Mountain Hardware
a&t = assembled & tested

S100 Bus

Cat No.	Mfr/Model	Description	Price
1601A	CCS-MXVI	16K STATIC RAM MODULE, 450ns kit	$285
1601B	CCS-MXVI	as above, 200ns kit	$330
1602A	CCS-MXVI	as above, 450ns a&t	$330
1602B	CCS-MXVI	as above, 200ns a&t	$375
1603	CCS-MXVI	as above, bareboard	$ 27
1600	CCS-PT1	WIREWRAP PROTOTYPING BOARD	$ 26
1604	CCS-PT2	SOLDERTAIL PROTOTYPING BOARD	$ 26
1609	CCS-PT3	ETCH PROTOTYPING BOARD	$ 16
1440	SSM-PB1	4K/8K EPROM BOARD	$135
1442	SSM-T1	TERMINATOR BOARD	$ 29
1405	SSM-MB7	16K STATIC RAM BOARD, kit	$329
1406	SSM-MB7	as above, a&t	$383
1407	SSM-MB7	as above, bareboard	$ 26
1425	SSM-MB3	2K/4K EPROM BOARD, kit	$ 54
1426	SSM-MB3	as above, a&t	$108
1436	SSM-MB9	4K STATIC PROM/RAM BOARD, kit	$ 64
1437	SSM-MB9	as above, a&t	$118
1429	SSM-OB1	VECTOR JUMP/PROTOTYPING CARD, kit	$47
1430	SSM-OB1	as above, a&t	$ 74
1431	SSM-OB1	as above, bareboard	$ 26
1414	SSM-IO2	UNIVERSAL I/O BOARD, kit	$ 48
1415	SSM-IO2	as above, a&t	$ 93
1416	SSM-IO2	as above, bareboard	$ 26
1408	SSM-SB1	MUSIC SYNTHESIZER, kit	$145
1409	SSM-SB1	as above, a&t	$212
1410	SSM-SB1	as above, bareboard	$ 35
1432	SSM-MT1	15 SLOT MOTHERBOARD, bareboard	$ 39
1411	SSM-IO4	2 PARALLEL + 2 SERIAL PORTS, kit	$139
1412	SSM-IO4	as above, a&t	$193
1413	SSM-IO4	as above, bareboard	$ 26
1403	SSM-CB1	8080A CPU BOARD, kit	$119
1441	SSM-CB1	as above, bareboard	$ 34
1404	SSM-CB1	as above, a&t	$164
1417	SSM-VB1B	VIDEO INTERFACE BOARD, kit	$129
1418	SSM-VB1B	as above, a&t	$176
1419	SSM-VB1B	as above, bareboard	$ 26
1400	SSM-MB6B	8K STATIC RAM BOARD, kit	$129
1401	SSM-MB6B	as above, a&t	$183
1402	SSM-MB6B	as above, bareboard	$ 26
1433	SSM-MB8A	16K, 2708 EPROM BOARD, kit	$ 88
1434	SSM-MB8A	as above, a&t	$118
1435	SSM-MB8A	as above, bareboard	$ 26
1438	SSM-VB2	VIDEO BOARD, kit	$139
1439	SSM-VB2	as above, a&t	$199
1420	SSM-MB4	STATIC RAM BOARD, kit, 2MHz	$ 89
1422	SSM-MB4	as above, a&t	$142
1424	SSM-MB4	as above, bareboard	$ 26
1324	WMC-EPM1	4K EPROM BOARD, bareboard	$ 28
1325	WMC-EPM2	16/32K EPROM BOARD, bareboard	$ 28
1322	WMC-FPB1	FRONT PANEL BOARD, bareboard	$ 48
1323	WMC-CPU1	8080A CPU BOARD, bareboard	$ 28
1337	WMC-FDC1	FLOPPY DISK CONTROLLER BOARD, bareboard	$ 48
1509	WMC-MEM1	8K STATIC RAM KIT, bareboard	$ 28
1510	WMC-MEM1	parts only for above	$ 80
1511	IA	2708/16 EPROM BOARD, bareboard	$ 28
1513	IA	8K STATIC RAM, bareboard	$ 28
1512	IA	Z-80A CPU BOARD, bareboard	$ 32
1514	IA	WIRE WRAP PROTOTYPING BOARD	$ 24
1500	HUH-MPA	PET & APPLE TO S-100 ADAPTER, kit	$199
1501	HUH-MPA	as above, a&t	$279
1505	MH	100,000 DAY CLOCK, a&t	$219
1506	MH	INTROL	$329
1518	SPL-20S	32 WORD SPEECHLAB, a&t	$189
1520	SPL-50S	64 WORD SPEECHLAB, a&t	$299
1516	SDS	VERSAFLOPPY, kit	$159
1517-0	SDS	EXPANDORAM, kit	$185
1517-16K	SDS	as above. with 16K RAM	$249
1517-32K	SDS	as above. with 32K RAM	$330
1517-48K	SDS	as above. with 48K RAM	$425
1517-64K	SDS	as above. with 64K RAM	$500

APPLE BUS

1607	CCS	SOLDERTAIL PROTOTYPING BOARD	$ 21
1606	CCS	WIREWRAP PROTOTYPING BOARD	$ 21
1608	CCS	ETCH PROTOTYPING BOARD	$ 18
1519	SPL	32 WORD SPEECHLAB	$189

FINALLY! PANAVISE at a Discount

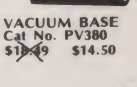
LOW PROFILE BASE
Cat No. PV305
~~$14.49~~ $10.50

STANDARD BASE
Cat No. PV300
~~$13.49~~ $10.50

BASE TRAY
Cat No. PV312
~~$ 9.95~~ $ 8.50

BASE MOUNTING CLAMP
Cat No. PV311
~~$11.95~~ $10.00

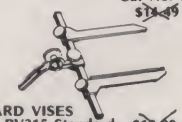
WIDE OPENING VISE HEAD
Cat No. PV366
~~$14.49~~ $11.25



VACUUM BASE
Cat No. PV380
~~$19.49~~ $14.50

STANDARD VISE HEAD
Cat No. PV303
~~$14.49~~ $11.25

HORIZONTAL VISE HEAD
Cat No. PV304
~~$15.49~~ $12.00



PC BOARD VISES
Cat No. PV315 Standard ~~$18.98~~ $14.75
Cat No. PV315 S-100 ~~$21.95~~ $16.75

IC Sockets
Penny-A-Pin

- *Texas Instruments*
- *Solder tail*
- *Package quantities only*

Order by Cat No. 1117 and pins

8 pin	20 for $1.60
14 pin	10 for $1.40
16 pin	10 for $1.60
18 pin	8 for $1.44
20 pin	8 for $1.60
22 pin	8 for $1.76
24 pin	3 for .72
28 pin	3 for .84
40 pin	2 for .80

TRS 80
Level III Basic

Loads on top of Level II, turns your TRS-80 into a powerful system. Gives disk commands without the DOS. Solves loading problems, cures keyboard bounce. Software cassette, with the power of a hardware modification. Guaranteed satisfaction.
Cat No. 1332 $49.00

$49

TRS 232
Printer Serial Interface $42

Software driven RS232 output port. Interface printers such as DIABLO, TELETYPE, TI SILENT, etc. Easy to install, with instructions.
Cat No. 1199 $42.00

16K Memory Add-On $95

- *For TRS-80, Apple II*

Guaranteed memory expansion! Includes everything you need...chips, jumpers, and step by step instructions. No special tools, no soldering!
Cat No. 1156

"LIFT-IT" PC Duplicating Kit, $25

Copy PC patterns from magazines quickly and easily! No additional materials required, no camera needed. With 10x12" sheet of film. We stock all refills. With step-by-step instructions.
Cat No. 1203 $25

TTL's

Order by type number

7400	.15	7490	.45
7402	.20	7491	.55
7403	.20	7492	.45
7404	.20	7493	.45
7405	.20	7495	.65
7406	.30	7496	.65
7407	.30	74107	.35
7408	.20	74109	.55
7409	.20	74121	.35
7410	.20	74122	.40
7411	.25	74123	.60
7412	.25	74126	.40
7413	.35	74132	.65
7414	.60	74141	.80
7416	.25	74145	.65
7417	.25	74150	.90
7420	.20	74151	.60
7423	.25	74153	.60
7425	.25	74154	1.00
7426	.25	74155	.70
7427	.25	74157	.60
7430	.25	74160	.85
7432	.25	74161	.75
7437	.25	74163	.75
7438	.45	74165	.95
7440	.20	74166	1.25
7441	.70	74170	1.60
7442	.50	74173	1.10
7443	.50	74174	.85
7444	.25	74175	.70
7445	.75	74176	.80
7446	.75	74177	.75
7447	.65	74180	.65
7450	.20	74181	1.75
7451	.20	74190	1.25
7453	.20	74191	.95
7454	.20	74192	.75
7470	.30	74193	.75
7472	.25	74194	.90
7473	.35	74195	.70
7474	.35	74198	1.49
7475	.45	74221	.85
7476	.35	74251	.80
7481	1.20	74273	1.00
7483	.60	74365	.65
7485	.75	74366	.65
7486	.35	74367	.65
7489	1.75	74368	.65

HUH 8100
TRS-80 to S100 Bus Adaptor

- *6 Slot motherboard*

Includes options such as serial RS232/20ma I/O, parallel input and output, space for 4K or 16K RAM, and more. Basic unit includes Bus interface and connectors only.

Cat No. 1460	Bus interface kit	$167
Cat No. 1461	Ram Support kit	$ 42
Cat No. 1462	I/O Option kit	$ 77
Cat No. 1463	5 connectors + guides	$ 42
Cat No. 1464	Complete Package	$266
Cat No. 1465	Bus Interface a&t	$220
Cat No. 1466	Complete Pkg. a&t	$340

Voltage Regulators

Type	Equal to	CASE	PRICE
7805K	LM340K + 5	TO-3	$1.40
7812K	LM340K + 12	TO-3	$1.40
7815K	LM340K + 15	TO-3	$1.40
7818K	LM340K + 18	TO-3	$1.40
7805T	LM340T + 5	TO-220	.95
7812T	LM340T + 12	TO-220	.95
7815T	LM340T + 15	TO-220	.95
7818T	LM34oT + 18	TO-220	.95
7905K	LM320K-5	TO-3	$1.75
7912K	LM430K-12	TO-3	$1.75
7905T	LM320T-5	TO-220	$1.25
7912T	LM320T-12	TO-220	$1.25
7915T	LM320T-15	TO-220	$1.25

LEEDEX
12" Video Monitor $139

- *TRS-80 compatible (no interfacing required)*
- *High resolution*

Accepts standard composite video input, no RF modulator necessary. Stable & sharp. Lightweight. Shipping $6 gnd, $12 air, USA only.
Cat No. 1204 $139.00

Send for FREE CATALOG Featuring

The best selection of computer accessories add-ons, factory fresh IC's, led's, semi's, software, PC aids, prototyping aids, books, test equipment, and more! Always updated! Dozens of new products every issue!

Pay by check, COD, Visa, or Mastercharge. Order by phone or mail. Please include phone number and magazine issue you are ordering from. USA: add $2 for shipping/handling, $3 for air. Foreign: add $3 for surface, $6 for air. COD's also add $1. Guaranteed satisfaction for 120 days or your money back!

Reader Service ✓ H25

19355 Business Center Dr. 6K8
Northridge CA 91324

Demonstration of

buccal-encephalographic

debugging techniques

for a bioarhythm program.

"The line to the secret of happiness is down. Will you settle for the secret of wealth?"

encyclopedia of microcomputing

4,600 pages

That's the size of the world's most comprehensive guide to microcomputing. Over 2 years of Kilobaud Microcomputing . . . a virtual expanding encyclopedia of computing.

Back issues of Kilobaud Microcomputing are a gold mine of interesting articles. There's little to go stale in microcomputing . . . software, applications, great editorials. Start your encyclopedia today by sending for our FREE KB Microcomputing Back Issues Catalog. You'll see every issue available with descriptions of each issue. Pick your favorites or get them all.

☐ YES! Rush me Microcomputing's FREE Back Issues Catalog!

Name _____

Address _____

City _____ State _____ Zip _____

kilobaud MICROCOMPUTING T.M.
Peterborough NH 03458

K8

kb microcomputing book nook

● **HOBBY COMPUTERS ARE HERE!**—BK7322—If you want to come up to speed on how computers work . . . hardware and software . . . this is an excellent book. It starts with the fundamentals and explains the circuits, the basics of programming, along with a couple of TVT construction projects, ASCII-Baudot, etc. This book has the highest recommendations as a teaching aid for newcomers. $4.95.*

● **THE NEW HOBBY COMPUTERS**—BK7340—This book takes it from where **Hobby Computers Are Here!** leaves off, with chapters on Large Scale Integration, how to choose a microprocessor chip, an introduction to programming, low cost I/O for a computer, computer arithmetic, checking memory boards, a Baudot monitor/editor system, an audible logic probe for finding those tough problems, a ham's computer, a computer QSO machine . . . and much, much more! $4.95*

● **INTRODUCTION TO MICROPROCESSORS**—BK1032—by Charles Rockwell of MICROLOG, is an ideal reference for the individual desiring to understand the hardware aspects of microprocessor systems. Describes the hardware details of computer devices in terms the beginner can understand, instead of treating the micro chip as a "black box." Specific systems are not described and programming is only briefly discussed. $17.50 U.S. and Canada; $20 elsewhere.*

● **BASIC NEW 2ND EDITION**—BK1081—by Bob Albrecht. Self-teaching guide to the computer language you will need to know for use with your microcomputer. This is one of the easiest ways to learn computer programming. $5.95.*

● **SCIENTIFIC RESEARCH INSTRUMENT'S BASIC SOFTWARE LIBRARY** is a complete do-it-yourself kit, written in everybody's BASIC, immediately executable in ANY computer with 8K; no other peripherals needed. **Volume I** contains business and recreational programs and is 300 pages. **Volume II** is 260 pages and contains math, engineering, statistics and plotting programs. **Volume III** contains money managing, advanced business programs such as billing, A/R, inventory, payroll, etc. **Volume IV** contains general purpose programs such as loans, rates, retirement, plus games: Poker, Enterprise (take charge while Capt. Kirk is away), Football and more! **Volume V** is filled with experimenters' programs, including games, pictures and misc. problems such as "logic." Volume I—LB1002—& Volume II—LB1003—$24.95* each, Volume III—LB1004—$39.95*, Volume IV—LB1005—& Volume V—LB1006—$9.95* each.

● **MICROPROCESSOR INTERFACING TECHNIQUES**—BK1037—by Austin Lesea & Rodnay Zaks will teach you how to interconnect a complete system and interface it to all the usual peripherals. It covers hardware and software skills and techniques, including the use and design of model buses such as the IEEE 488 or S100. $9.95.*

● **TTL COOKBOOK**—BK1063—by Donald Lancaster. Explains what TTL is, how it works, and how to use it. Discusses practical applications, such as a digital counter and display system, events counter, electronic stopwatch, digital voltmeter and a digital tachometer. $8.95.

● **CMOS COOKBOOK**—BK1011—by Don Lancaster. Details the application of CMOS, the low power logic family suitable for most applications presently dominated by TTL. Required reading for every serious digital experimenter! $9.95.*

● **TVT COOKBOOK**—BK1064—by Don Lancaster. Describes the use of a standard television receiver as a microprocessor CRT terminal. Explains and describes character generation, cursor control and interface information in typical, easy-to-understand Lancaster style. $9.95.*

● **THE "COMPULATOR" BOOK—BUILDING SUPER CALCULATORS & MINICOMPUTER HARDWARE WITH CALCULATOR CHIPS**—BK1012—by R.P. Haviland, provides ideas, design info and/or printed circuit boards for calculator chip projects such as tape control of calculator electronic lock, dial-a-telephone, etc. $7.95.*

● **BASIC COMPUTER GAMES**—BK1074—Okay, so once you get your computer and are running in BASIC, then what? Then you need some programs in BASIC, that's what. This book has 101 games for you from very simple to real buggers. You get the games, a description of the games, the listing to put in your computer and a sample run to show you how they work. Fun. Any one game will be worth more than the price of the book for the fun you and your family will have with it. $7.50.*

● **WHAT TO DO AFTER YOU HIT RETURN**—BK1071—PCC's first book of computer games . . . 48 different computer games you can play in BASIC . . . programs, descriptions, many illustrations. Lunar Landing, Hammurabi, King, Civel 2, Qubic 5, Taxman, Star Trek, Crash, Market, etc. $10.95.*

● ***MICROCOMPUTING* CODING SHEETS** *Microcomputing's* dozen or so programmers wouldn't try to work without these handy scratch pads, which help prevent the little errors that can cost hours and hours of programming time. Available for programming is **Assembly/Machine Language** (PD1001), which has columns for address, instruction (3 bytes), source code (label, op code, operand) and comments; and for **BASIC** (PD1002) which is 72 columns wide. 50 sheets to a pad. $2.39.*

*Use the order card in the back of this magazine or itemize your order on a separate piece of paper and mail to:
Kilobaud **Microcomputing** Book Department ● Peterborough NH 03458. Be sure to include check or detailed credit card information.
All orders, add $1.00 handling.

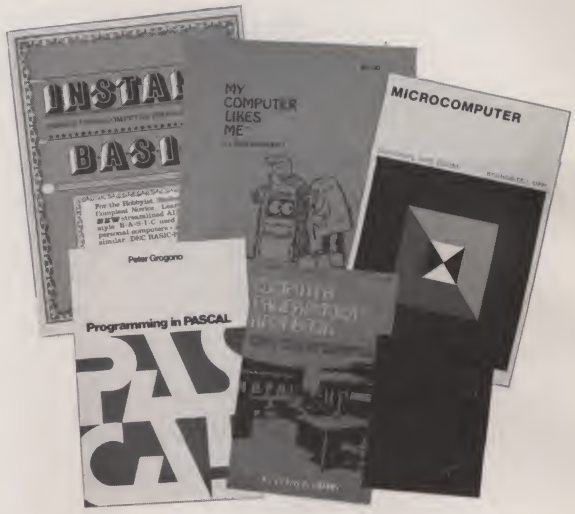
FOR TOLL FREE ORDERING CALL 1-800-258-5473

kb microcomputing book nook

● **PROGRAMMING IN PASCAL**—BK1140—by Peter Grogono. The computer programming language PASCAL was the first language to embody in a coherent way the concepts of structured programming, which has been defined by Edsger Dijkstra and C.A.R. Hoare. As such, it is a landmark in the development of programming languages. PASCAL was developed by Niklaus Wirth in Zurich; it is derived from the language ALGOL 60 but is more powerful and easier to use. PASCAL is now widely accepted as a useful language that can be efficiently implemented, and as an excellent teaching tool. It does not assume knowledge of any other programming language; it is therefore suitable for an introductory course. $9.95.*

● **MICROPROCESSOR LEXICON—ACRONYMS AND DEFINITIONS**—BK1040—compiled by the staff of SYBEX, is a convenient reference in pocket-size format. Sections include acronyms and definitions, part numbers and their definitions, S-100 signals; RS232 signals, IEEE 499 signals, microcomputers and microprocessors, JETDS summary (military) and a code conversion table. $2.95.*

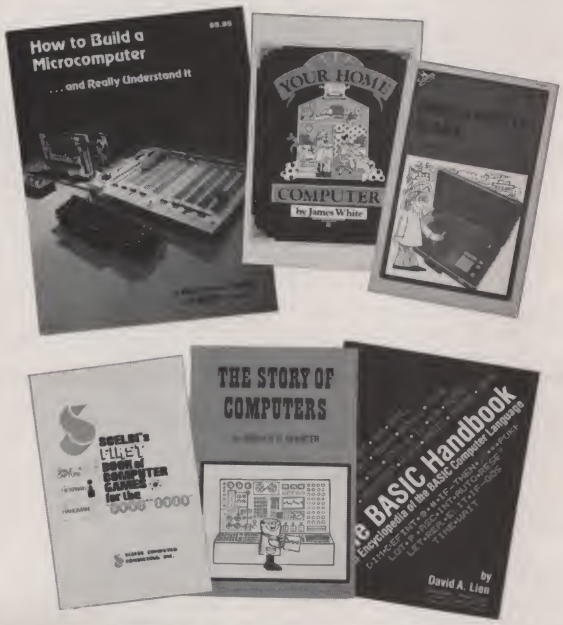
● **INSTANT BASIC**—BK1127—by Jerald R. Brown. For the personal computer enthusiast or the user of DEC's BASIC PLUS language, here is a new book to teach you BASIC. It teaches BASIC to beginners using interesting programming ideas and applications that will be easily understood by the home computer programmer. BASIC PLUS users know that the two languages are very similar, so this book can be used by them as well. This is an "active participation" workbook, designed to be used with your home computer so you can learn by doing! Ideas are slowly introduced in a nonmathematical context so the beginner can quickly learn good programming techniques. $6.00.*



● **MY COMPUTER LIKES ME . . . WHEN I SPEAK BASIC**—BK1039—An introduction to BASIC . . . simple enough for kids. If you want to teach BASIC to anyone quickly, this is the way to go. $2.00.*

● **COMPUTER PROGRAMMING HANDBOOK**—BK1014—by Peter Stark. A complete guide to computer programming and data processing. Includes many worked-out examples and history of computers. $9.95.*

● **MICROCOMPUTER DICTIONARY**—BK1034—This microcomputer dictionary fills the need to become quickly acquainted with the terminology and nomenclature of the revolution in computers. There is also a comprehensive electronics/computer abbreviations and acronyms section. $15.95.*



● **YOUR HOME COMPUTER**—BK1172—by James White, is an introduction to the world of personal microcomputing. This book tells you everything you want to know about home computing and gives the computer novice a painless introduction to microcomputer technology and terminology, beginning with what computers are and how they work. This basic book requires no prior knowledge or experience in electronics or computing. It provides information about home computer kits; guidelines for selecting and building your own microcomputer, how to use your home computer and what you can do with it; lists of computer stores, clubs, periodicals; and answers to many more of your questions about microcomputers and the jargon surrounding the personal computing scene today. $6.00.*

● **HOW TO BUILD A MICROCOMPUTER—AND REALLY UNDERSTAND IT**—BK7325—by Sam Creason. The electronics hobbyist who wants to build his own microcomputer system now has a practical "How-To" guidebook. This book is a combination technical manual and programming guide that takes the hobbyist step-by-step through the design, construction, testing and debugging of a complete microcomputer system. Must reading for anyone desiring a true understanding of small computer systems. $9.95.*

THE BASIC HANDBOOK—BK1174—by David Lien. This book is unique. It is a virtual ENCYCLOPEDIA of BASIC. While not favoring one computer over another, it explains over 250 BASIC words, how to use them and alternate strategies. If a computer does not possess the capabilities of a needed or specified word, there are often ways to accomplish the same function by using another word or combination of words. That's where the HANDBOOK comes in. It helps you get the most from your computer, be it a "bottom-of-the-line" micro or an oversized monster. $14.95.*

● **SCELBI'S FIRST BOOK OF COMPUTER GAMES**—BK1048—Need a game for your 8008 or 8080 microprocessor? This book has three popular games: "Space Capture," "Hexpawn" and "Hangman." Complete flowcharts, logic description, program listing and instructions are provided. A must for the game freak! $14.95.*

● **MICROCOMPUTER PRIMER**—BK1035—by M. Waite and M. Pardee. Describes basic computer theory, explains numbering systems and introduces the reader to the world of programming. Describes the world of microcomputing in "real world" terminology. $7.95.*

● **THE STORY OF COMPUTERS**—BK1056—by Donald D. Spencer, is to computer books what *Dick and Jane* is to novels . . . elementary, gives the non-computerist a fair idea of what the hobbyist is talking about when he speaks computer lingo. Attempts to explain what computers are and can do to a spouse, child or any non-electronics-minded friend. $4.95.*

*Use the order card in the back of this magazine or itemize your order on a separate piece of paper and mail to:
Kilobaud **Microcomputing** Book Department ● Peterborough NH 03458. Be sure to include check or detailed credit card information.
All orders, add $1.00 handling.

FOR CUSTOMER SERVICE CALL 603-924-7298

kb microcomputing book nook

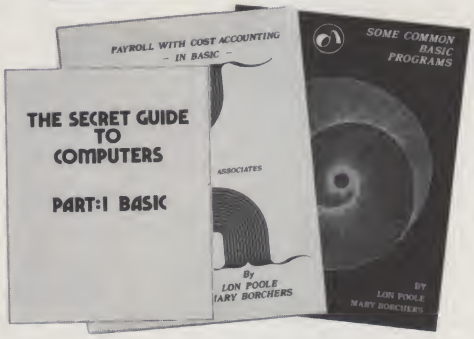
● **AN INTRODUCTION TO MICROCOMPUTERS, VOL. 0**—BK1130—The Beginner's Book—Written for readers who know nothing about computers—for those who have an interest in how to use computers—and for everyone else who must live with computers and should know a little about them. The first in a series of 4 volumes, this book will explain how computers work and what they can do. Computers have become an integral part of life and society. During any given day you are affected by computers, so start learning more about them with Volume 0. $7.95.*

● **VOL. I**—BK1030—Dedicated to the basic concepts of microcomputers and hardware theory. The purpose of Volume I is to give you a thorough understanding of what microcomputers are. From basic concepts (which are covered in detail), Volume I builds the necessary components of a microcomputer system. This book highlights the difference between minicomputers and microcomputers. $9.50.*

● **VOL. II**—BK1031 (loose leaf)—$25.00*; BK1040 (with binder)—$30.00*—Contains descriptions of individual microprocessors and support devices used only with the parent microprocessor. Volume II describes all available chips.

● **VOL. III**—BK1132 (loose leaf)—$15.00*; BK1133 (with binder)—$20.00.* Contains descriptions of all support devices that can be used with any microprocessor.

● **FUN WITH COMPUTERS AND BASIC**—BK1021—by Donald D. Spencer, contains an easy-to-understand explanation of the BASIC Programming Language and is intended for persons who have had no previous exposure to computer programming. Over half the book is devoted to problems using games, puzzles, and mathematical recreations. A superior book for self-teaching and learning computer programming. $6.95.*



● **ADVANCED BASIC**—BK1000—Applications and problems by James Coan is for those who want to extend their expertise with BASIC. Offers advanced techniques and applications. $7.95.*

● **PAYROLL WITH COST ACCOUNTING—IN BASIC**—BK1001—by L. Poole & M. Borchers, includes program listings with remarks, descriptions, discussions of the principle behind each program, file layouts, and a complete user's manual with step-by-step instructions, flowcharts, and simple reports and CRT displays. Payroll and cost accounting features include separate payrolls for up to 10 companies, time-tested interactive data entry, easy correction of data entry errors, job costing (labor distribution), check printing with full deduction and pay detail, and 16 different printed reports, including W-2 and 941. $12.50.*

● **SOME COMMON BASIC PROGRAMS**—BK1053—published by Adam Osborne & Associates, Inc. Perfect for non-technical computerists requiring ready-to-use programs. Business programs, plus miscellaneous programs. Invaluable for the user who is not an experienced programmer. All will operate in the stand-alone mode. $9.50 paperback.*

● **THE SECRET GUIDE TO COMPUTERS** Parts 1, 2 and 3 by Russ Walter. **Part One** describes computers in general, and after reading for ten minutes you will be writing simple BASIC programs! **Part Two** discusses computer applications. It's one thing to master the syntax of the language such as BASIC and another to solve problems using the new tool. **Part Three** describes programming languages. Ever heard of APL and QLISP? BASIC is not the only language used to program computers. 7th Edition. Part I—BK1050—$2.75*; Part II—BK1051—$2.50*; Part III—BK1052—$3.50.*

*Use the order card in the back of this magazine or itemize your order on a separate piece of paper and mail to:
Kilobaud **Microcomputing** Book Department ● Peterborough NH 03458. Be sure to include check or detailed credit card information.
All orders, add $1.00 handling.

KB BOOK NOOK ORDER FORM

Qty.	Cat. #	Description	Unit Price	Total
			Add $1 Handling	
			Total	

Enclosed $ _____ ☐ Check ☐ Money Order

☐ Master Charge ☐ VISA ☐ American Express

Credit card #_____ Exp. date_____ Signature_____

Name_____

Address_____

City_____ State_____ Zip _____

Coupon expires in 60 days

kilobaud MICROCOMPUTING T.M.
Peterborough NH 03458

KB 8/79

FOR TOLL FREE ORDERING CALL 1-800-258-5473

kilobaud

MICROCOMPUTING T.M.

LIST OF ADVERTISERS

A90	Aardvark Technical Services	75
A88	AB Computers	86
A75	ACS Service	17
A73	Addmaster Corp	139
A38	Advanced Comp. Products	163
A66	American Square Comp	139
A22	A. P. Products	93
A98	Bill Archbold	86
A99	Arjay Enterprises	124
A89	August Automation	82
A79	Austin Electronics	137
A71	Automated Simulations	142
B4	B & F Enterprises	153
B50	Bluebird's Inc	51
B33	The Bottom Shelf, Inc	71
B43	Buss	146
C128	Cecdat, Inc	148
C136	Centronics Data Comp. Corp	20
C122	CompuCover	51
C109	CompuSoft Publishing	75
C64	Computer Corner of NJ	101
C77	Computer Data Publishing	124
C146	The Computer Exchange	141
*	The Computer Factory	23
C111	Computer Forum	76
C80	Computer Port	63
C104	Computer Information Exchg	76
C135	The Computer Shack	82
C147	The Computer Stop	62
*	Computer Sys. Design	128,147
C81	Computers One	127
C86	Computrex	75
C114	Computronics	71
C107	Connecticut microComputer	133
C124	Cost Effective Services	117
C108	The CPU Shop	132
C123	Cuddly Software	82
C145	Cursor Magazine	76
C132	Custom Electronics	139
C129	Cybernetics, Inc	45,149
D43	Dr. Daley	82
D50	Data/Print	135
D57	Data Comm. Interna't., Inc	148
D40	Datasearch	45
D46	Data-Trans	129
D32	Data Vector Corp	86
D28	Deltroniks	143
D52	Device Oriented Games, Inc	144
*	Digital Dynamics, Inc	135
D20	Digital Research Corp	162
E34	Ecosoft	146
E37	80-US	133
E47	Electronic Control Tech	21
E36	Electronic Specialists, Inc	82
E21	Electronic Systems	157
E46	Exar	22
E48	Exatron	13
F18	Fuller Electronics	51
G28	Gimix, Inc	117
G4	Godbout Electronics	147,169
G24	GPA Electronics	61
G20	Graham-Dorian Enterprises	21
H37	Hayden Book Company	125
H43	Hayes Data Systems, Inc	147
H41	Hebbler Software Services	86
H25	Hobby World	172
H45	Houston Micro-Comp. Tech. Inc	170
H29	HUH Electronics	143
I40	Infotecs, Inc	20
I24	Innovative Technology	51
I32	Instant Software	15,87,88,89
I13	Integrand	96
I9	Integrated Circuits Unltd	168
I41	InterSystems	21
I21	Intertec Data Systems	3
*	Ithaca Audio	21
J6	Jade Computer Prod	158,159
J1	Jameco Electronics	160,161
J13	J.E.S. Graphics	136
J12	JPC Products	129
K14	Key Electronics	82
*	Kilobaud	83
L22	Larks Electronics & Data	57
L24	R. Leslie Electronics Lab	136
L19	Level IV Products, Inc	144
L16	Lifeboat Associates	48
M77	Madhatter Software	77
M88	The Mail Mart	123
M102	Man-Computer Sys., Inc	117
M17	Marketline, Inc	149
M93	Metamics, Inc	141
M74	Micro	133
M103	Micro Applications Group	143
M30	Micro Computer Devices	29,33
M82	Microcomputer Tech., Inc	124
M73	Micromail	49
M95	Micro Management Sys	141
M54	Micro-Mega	141
M81	Micro Products Unltd	123
M67	Microsette Co	139
M44	Micro Technology Unltd	93
M94	Mid East Micro	133
M70	Midwest Scientific	CIV
M39	Mikos	156
M6	Mini Micro Mart	150
M98	Minnesota Micro Systems	129
M83	Multi Business Comp. Sys	117
M87	Mumford Micro Systems	86
N12	NEECO	144,145
N15	Netronics R & D Ltd	125
N7	Newman Comp. Exchg	152,165
O1	Ohio Scientific	8,9,22
O5	OK Machine & Tool	37
O2	On-Line	128
O10	Optimal Technology, Inc	149
O14	Organic Software	123
O8	Orthon Computers	124
O6	Osborne & Associates	43
O9	Otto Electronics	128
P9	PAIA	142
P7	Percom Data Co., Inc	CII,20
P54	Percom Data Co., Inc	107
P59	Percom Data Co., Inc	106
P52	The Peripheral People	136
P39	Personal Software	113,117
*	Plainsman Micro Systems	124
P60	Practical Applications	142
P46	Pragmatic Designs, Inc	22
P21	Priority One	166,167,171
P48	Programma Interna't. Inc	25
*	Robert Elliott Purser	57
P55	Pygmy Programming	141
Q9	Quasar Data Products	127
Q3	Quest Electronics	151
R24	Racet Computes	42
R34	Radio Shack Auth. Sales Ctr	136
	Rainbow Computing, Inc	42
R8	Ramsey Electronics	138
R32	REAL-LIFE Simulations	51
R33	Realty Software Co	123
*	The Recreational Programmer	149
R20	RNB Enterprises	154,155
R7	Rondure Company	105
S99	Saylor Elec. Interna't. Inc	20
S1	Scelbi Publications	141
S101	Semiconductor Surplus	123
S76	Steven E. Shaw, P.E	135
S74	68 Micro Journal	136
S92	Small Business Applica	142
S51	Small System Software	146
S97	The Software Assoc	144
S60	S-100, Inc	127
S52	Southeastern Software	75
S61	Supersoft	75
S42	Sybex, Inc	97
T57	Taranto & Associates	126
T11	Tarbell Electronics	48
T67	Technical Products Co	123
T26	Telecommunications Serv	117
T28	Thinker Toys	CIII
T50	Tiny C Associates	101
T65	3G Co., Inc	21
T56	TNW Corp	124
T58	Tora Systems Limited	45
T41	Total Information Serv., Inc	139
T46	Transition Enterprises, Inc	139
T66	Trendcom	22
U12	Ultimate Computer Sys	57
V20	Vista Computer Company	124
V22	VM Profes. App. Software, Ltd.	86
V19	VR Data Corporation	140
*	Wallen Electronics	164
W22	Wameco, Inc	156
W13	Wasatch Semiconductor Products	148
W20	WEB Associates	148
W29	West Side Electronics	124
W25	Western Digital Corp	109
W21	Western I/O	134
W16	World Wide Electronics	141
X4	Xitex Corp	139
X2	X & Y Enterprises	75
Y2	Young's	141

From Kilobaud 83,173-178

*Reader Service inquiries not honored. Please contact advertiser directly.

READER SERVICE

receive more information from any of the advertisers in this issue of Kilobaud **Microcomputing**, postage-paid return cards are provided here for your convenience. If you wish to hear from one or several advertisers, refer to the ad itself. You will find numbers near the logo of each advertiser. Each represents the advertiser's individual **Reader Service** number. Circle the corresponding numbers on one of the cards on this page, include your name, address & zip and drop in the mailbox. In four to six weeks you'll hear from the advertiser directly.

READER SERVICE REPLY CARD

Return this card to receive full information on the many products advertised in this issue. Limit: 25 requests. ☐ Subscriber. ☐ Newsstand. This card is valid until September 30, 1979.

A22	B33	C114	D28	E47	I9	L19	M77	N12	P39	R20	S92	T65	W29
A38	B43	C122	D32	E48	I13	L22	M81	N15	P46	R24	S97	T66	X2
A66	B50	C123	D40	F18	I21	L24	M82	O1	P48	R32	S99	T67	X4
A71	C64	C124	D43	G4	I24	M6	M83	O2	P52	R33	S101	U12	Y2
A73	C77	C128	D46	G20	I32	M17	M87	O5	P54	R34	T11	V19	MICROCOMPUTING
A75	C80	C129	D50	G24	I40	M30	M88	O6	P55	S1	T26	V20	
A79	C81	C132	D52	G28	I41	M39	M93	O8	P59	S42	T28	V22	
A88	C86	C135	D57	H25	J1	M44	M94	O9	P60	S51	T41	W13	
A89	C104	C136	E21	H29	J6	M54	M95	O10	Q3	S52	T46	W16	
A90	C107	C145	E34	H37	J12	M67	M98	O14	Q9	S60	T50	W20	
A98	C108	C146	E36	H41	J13	M70	M102	P7	R7	S61	T56	W21	
A99	C109	C147	E37	H43	K14	M73	M103	P9	R8	S74	T57	W22	
B4	C111	D20	E46	H45	L16	M74	N7	P21	R12	S76	T58	W25	

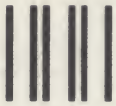
This month's ARTICLE WINNER (title page number): _____

Name _____
(PLEASE TYPE OR PRINT CLEARLY)

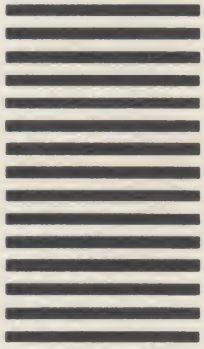
Address _____

City _____ State _____ Zip _____

KB 8/79



NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES



BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 17 PETERBOROUGH NH 03458

POSTAGE WILL BE PAID BY ADDRESSEE

kilobaud
MICROCOMPUTING T.M.
peterborough nh 03458

Att: Mail Order

READER SERVICE REPLY CARD

Return this card to receive full information on the many products advertised in this issue. Limit: 25 requests. ☐ Subscriber. ☐ Newsstand. This card is valid until September 30, 1979.

A22	B33	C114	D28	E47	I9	L19	M77	N12	P39	R20	S92	T65	W29
A38	B43	C122	D32	E48	I13	L22	M81	N15	P46	R24	S97	T66	X2
A66	B50	C123	D40	F18	I21	L24	M82	O1	P48	R32	S99	T67	X4
A71	C64	C124	D43	G4	I24	M6	M83	O2	P52	R33	S101	U12	Y2
A73	C77	C128	D46	G20	I32	M17	M87	O5	P54	R34	T11	V19	MICROCOMPUTING
A75	C80	C129	D50	G24	I40	M30	M88	O6	P55	S1	T26	V20	
A79	C81	C132	D52	G28	I41	M39	M93	O8	P59	S42	T28	V22	
A88	C86	C135	D57	H25	J1	M44	M94	O9	P60	S51	T41	W13	
A89	C104	C136	E21	H29	J6	M54	M95	O10	Q3	S52	T46	W16	
A90	C107	C145	E34	H37	J12	M67	M98	O14	Q9	S60	T50	W20	
A98	C108	C146	E36	H41	J13	M70	M102	P7	R7	S61	T56	W21	
A99	C109	C147	E37	H43	K14	M73	M103	P9	R8	S74	T57	W22	
B4	C111	D20	E46	H45	L16	M74	N7	P21	R12	S76	T58	W25	

This month's ARTICLE WINNER (title page number): _____

Name _____
(PLEASE TYPE OR PRINT CLEARLY)

Address _____

City _____ State _____ Zip _____

KB 8/79

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 17 PETERBOROUGH NH 03458

POSTAGE WILL BE PAID BY ADDRESSEE

kilobaud
MICROCOMPUTING T.M.
peterborough nh 03458

ATTN: READER SERVICE

BOOK NOOK ORDER FORM

Please send me the following KB/MC products: (please print or type!)

Qty.	Catalog #	Description	Unit Price	Total
			Add $1.00 Handling:	
			Total:	

Enclosed $_____ ☐ Check ☐ Money order

Bill: ☐ American Express ☐ BankAmericard/Visa ☐ MasterCharge

Credit Card # _____

Expiration date_____Signature _____

Name _____

Address _____

City_____State_____Zip _____

KB 8/79

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 17 PETERBOROUGH NH 03458

POSTAGE WILL BE PAID BY ADDRESSEE

kilobaud
MICROCOMPUTING T.M.
peterborough nh 03458

ATTN: READER SERVICE

kilobaud MICROCOMPUTING books, etc.

BK1000 Advanced BASIC—$7.95

BK1074 BASIC Computer Games—$7.5

BK1081 BASIC New 2nd Edition—$5.95

BK1174 The BASIC Handbook—$14.95

BN1011 Binder—KB—1—$6.50

BN1012 Binder—KB—2 & up—$6.00 ea

BK1011 CMOS Cookbook—$9.95

BK1012 The "Compulator" Book—Buil Super Calculators & Minicomputer H ware With Calculator Chips—$7.95

BK1014 Computer Programming H book—$9.95

BK1021 Fun With Computers & BAS $6.95

BK7322 Hobby Computers Are Here!—$

BK1131 Instant BASIC—$6.00

Introduction to Microcomputers
BK1130 Vol. 0—$7.95;
BK1030 Vol. I—$9.50;
BK1031 Vol. II (loose leaf)—$25.00;
BK1040 Vol. II (with binder)—$30.00;
BK1132 Vol. III (loose leaf)—$15.00;
BK1133 Vol. III (with binder)—$20.00

BK1032 Introduction to Micro cessors—$17.50 USA; $20 Elsewher

Kilobaud Coding Sheets PD1001—As bly/Machine Language—$2.39; PD —BASIC—$2.39

BK1034 Microcomputer Dictionary—$1

BK1035 Microcomputer Primer—$7.95

BK1037 Microprocessor Interfacing T niques—$9.95

BK1137 Microprocessor Lexicon—A nyms and Definitions—$2.95

BK1039 My Computer Likes Me . . . Wh Speak BASIC—$2.00

BK7340 The New Hobby Computers—$

BK1001 Payroll With Cost Accounting BASIC—$12.50

BK1140 Programming in PASCAL—$9.

BK1048 Scelbi's First Book of Comp Games—$14.95

Scientific Research Instruments' BA Software Library
LB1002 Vol. I—$24.95, LB1003 Vol. $24.95, LB1004 Vol. III—$39.95, LB Vol. IV—$9.95, LB1006 Vol. V—$9.9

The Secret Guide To Computers.
BK1050 Part I—$2.75; BK1051 Part $2.50; BK1052 Part III—$3.50

BX1000 Shelf Box—1—$2.00

BX1001 Shelf Box—2—$1.50 each

BX1002 Shelf Box—8 up—$1.25 each

BK1053 Some Common BASIC Progra $9.50

BK1056 The Story of Computers—$4.9

BK1063 TTL Cookbook—$8.95

BK1064 TVT Cookbook—$9.95

BK1071 What To Do After You Hi turn—$10.95

BK1172 Your Home Computer—$6.00

DOUBLE DENSITY

SOLID SAVINGS!

Now you can put your S-100 system solidly into a full-size, single/double density, 600K bytes/side disk memory for just $1149 complete.

DISCUS/2D™ single/double density disk memory from Thinker Toys™ is fully equipped, fully assembled, and fully guaranteed to perform perfectly.

DISCUS/2D™ is a second generation disk memory system that's compatible with the new IBM System 34 format. The disk drive is a full-size Shugart 800R, the standard of reliability and performance in disk drives. It's delivered in a handsome cabinet with built-in power supply.

The S-100 controller utilizes the amazing Western Digital 1791 dual-density controller chip . . . plus power-on jump circuitry, 1K of RAM, 1K of ROM with built-in monitor, and a hardware UART to make I/O interfacing a snap.

The DISCUS/2D™ system is fully integrated with innovations by designer/inventor George Morrow. Software includes BASIC-V™ virtual disk BASIC, DOS, and DISK-ATE™ assembler/editor. Patches for CP/M* are also included. CP/M*, MicroSoft Disk BASIC and FORTRAN are also available at extra cost.

DISCUS/2D™ is the really solid single/double density disk system you've been waiting for. We can deliver it now for just $1149. And for just $795 apiece, you can add up to 3 additional Shugart drives to your system. Both the hardware and software are ready when you are.

Ask your local computer store to order the DISCUS/2D™ for you. Or, if unavailable locally, write Thinker Toys,™ 5221 Central Ave., Richmond, CA 94804. Or call (415) 524-2101 weekdays, 10-5 Pacific Time. (FOB Berkeley. Cal. res. add tax.)

*CP/M is a trademark of Digital Research.

Morrow makes disk memory for

Thinker Toys™

Inventory Problems?

Are you having trouble keeping the right nuts and bolts in stock? Since even a simple mistake can cost you time and money, a good inventory system should do more than just count parts. It should tell you exactly what you need, when you need it, where to get it, and how much it will cost.

The MSI Inventory System Seven enables you to maintain a versatile data base for controlling inventory. It lists part number, description, quantity on hand, vendor, cost, selling price, optional pricing, usage levels for previous month, present month, and year-to-date, and much more.

When quantity on hand items reach minimum levels, the System Seven compiles an automatic reorder list. This list can be generated by specific vendor as well as a complete listing of all materials to be ordered.

In addition to the item listing, the Inventory System Seven "bill of materials" provides you with a complete inventory of items used in the manufacture of subassemblies and complete products. It also contains other cost items such as labor costs, total raw materials costs, and miscellaneous costs.

The MSI Inventory System Seven is built around the versatile MSI 6800A Computer with 56K of RAM. An integral dual mini-floppy memory gives you an additional 630K of memory and makes inventory control fast and efficient. The System Seven will interface with any industry standard CRT, and you have the option of both a "daisy wheel" word processor for high quality document preparation and a dot matrix printer for high speed production.

The System Seven can be expanded to handle all your data processing needs or you can select one of nine other MSI systems now available for business, industrial, scientific, educational, and personal applications.

If you need more than just a nuts and bolts inventory system, we have more information about how the Inventory System Seven can solve your problems economically.

MSI Inventory System Seven

MSI

Midwest Scientific

220 W. Cedar, Olathe, Kansas 66061, (913) 764-3273
TWX 910 749 6403 (MSI OLAT), TELEX 42525 (MSI A OLAT)